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THE THIRTY-FOURTH CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

It might have been expected that with so many attractions offered by the great metropolis that there would have been some difficulty in holding close to the serious work a majority of those who attended the convention of the National Electric Light Association held in New York City last week. Contrariwise and in spite of a terrific volume of business, the attendance upon every session was remarkable. The registration mark was considerably beyond 5,000 and this did not include a great many persons unattached who were not included in the official registration of the convention. Taking it all in all it must be considered the most successful convention the Association has ever held, although the lack of exhibition facilities made the burden of those manufacturers not maintaining elaborate headquarters pretty heavy. The manufacturers have been loyal supporters of the Association for a long time and while there may be some question in the minds of many as to their exact status with relation to the Association, they are entitled through their contributions and their presence to a generous share of opportunity in so important a gathering as this.

In reviewing the outstanding features of the convention, praise must first of all be given to the generous spirit of hospitality which marked the entire proceedings. The opening reception and promenade was a proper beginning for so brilliant an occasion, and the cordiality extended by the electrical men in New York, particularly by the New York Edison Company and the Edison Electric Illuminating Company of Brooklyn, entitles them to our highest commendations. The conspicuous participation of ladies in the lighter features of the convention proceedings was decidedly marked, and the committees in charge labored very successfully for their edification and entertainment.

The attendance of Edison at one of the convention sessions was a unique and much appreciated event. Although the great inventor did not address the assembly, his response was fittingly and gracefully made by Mr. Insull. The election of C. A. Coffin as an honorary member of the Association and his stirring words gave inspiration and stimulus to all who had the good fortune to be present at this impromptu reception. Beyond any doubt, however,

the crowning event of the convention was the Public Policy meeting held at the New Theater, when the Association went definitely on record with a very practicable plan for establishing a desirable mutuality of interest between employer and employee. So important is this development and so practicable the plans outlined by the Public Policy Committee that they have secured the hearty endorsement of President Taft and received the spoken commendation of one of his Cabinet chiefs, Secretary Nagel of the Department of Commerce and Labor.

Although of most recent origin, the Commercial Section showed a vigorous development and it is here that probably the greatest growth will come. It is through the Commercial Section that adequate return for the investment must be secured and it is through the development of new ideas and aggressive campaigns in the Commercial Department that the network of electrical distribution will be extended to cover every form of industrial and domestic utilization that the world is waiting for in the future. It is in these departments also that great opportunities await the young progressives in the central-station industry, and it is a very satisfactory commentary on this development that two of the most recent presidents have achieved their careers largely in the commercial end of the business.

The Commercial Section banquet, given by J. Robert Crouse and George Williams, was a most enjoyable affair and the contest for the silver loving cup presented by Mr. Crouse proved a decided stimulus to the activity of hosts of men in building up the membership of this section.

Notwithstanding the aggressiveness of the Commercial Section and the volume of reports and discussion which its program entailed, the general sessions and the technical, power transmission and accounting sessions were replete with valuable information. In this connection, however, it might be pointed out that there is still further opportunity for concentration upon the very important phase of central-station work which is of a purely operating characteristic. It is a fact that the operating managers of a great many of the smaller central stations have found a dearth of papers and discussion respecting their particular work, and this is an item which must be reckoned with as time goes on.

The presentation of the portrait of Miss Harriet Billings by Henry L. Doherty is a splendid tribute to a remarkable woman. To those who have been familiar with the work of the National Electric Light Association, the faithful and diligent service rendered by Miss Billings, and her literary ability as the editor of the proceedings of the Association will always be recognized as the highest exemplification of work well done.

The work of the secretary's office has grown at a phenomenal rate and the masterly handling of details is just what we might have expected from so consummate a diplomat and engineer of forces as T. C. Martin.

The record of achievement set by Mr. Freeman as president of the Association establishes for his successor an opportunity worthy of the man elected to the office, and no greater appreciation of the sterling qualities of manhood and the evidences of capability could be extended to John F. Gilchrist than the sincere congratulations of Mr. Freeman and his prediction that the coming administration would be the crowning success of the Association's work.

IMPROVING POWER-PLANT SERVICE.

Increased efficiency of power production is sought by two general methods: analysis of the relation of station design to initial costs, eliminating, so far as possible, expenditures which are not absolutely essential to reliable and economical service, and the introduction of equipment and means of handling service with minimum labor and fuel consumption, combined with administrative policies tending to increase the ease and accuracy of operation. Emphasis was recently laid in these columns upon the importance of a moderate investment, particularly in hydroelectric stations. Attention may now be called to two or three ways in which the service of the established station may be improved, with results leading toward greater effectiveness of the organization, and consequently to decreased expenses for a given amount of work.

The value of machinery installed in modern power plants is constantly increasing as connected loads grow larger, and the importance of maintaining continuous service and of reestablishing the delivery of electrical energy as soon as possible after a shut-down lays a great responsibility upon men in charge of present-day stations. Perhaps nothing is of more importance in this connection than the provision of a permanent supply of current for station lighting under all anticipated conditions. It is difficult to imagine anything more annoying than to lose all the station lights through the blowing of a fuse, sticking of a circuit-breaker, or failure of the generator supplying lighting current at a time when the high-powered apparatus is in trouble. It is a common practice in many plants to light the station from either the main or exciter busbars, and to depend upon candles or oil lanterns in case anything goes wrong. With the modern generating and transforming equipment of large capacity, too much can happen while lights are being extemporized to take any chances of burnouts or mechanical injuries resulting from heavy shorts. More than one source of lighting current is essential in stations carrying heavy responsibilities, and where the local central station or street-railway plant is separated from the installation in question, the provision of a breakdown lighting service is an exceedingly cheap means of insurance. The importance of this has long been recognized in rapid-transit tunnel and theater illumination, but it is not yet sufficiently appreciated in self-contained generating plants.

The use of storage batteries for the operation of remote-control oil-switch solenoids provides a possible auxiliary source of lighting current which may well be utilized. Where an

exciter battery is in service the same thing can be said, and in such cases an external supply is probably needless. But since many plants are not thus equipped, it is necessary to fall back upon duplicate services within the station to insure permanent lighting, and these properly include a double-throw switching equipment which will offer a choice between a step-down transformer connected with the main busbars and a line from the exciter bus. In some plants the lighting circuits are partially duplicated, and extra lines are run to the switchboard, high-tension rooms, principal boiler valves and gauges, and the main generating units and auxiliaries. Since trouble rarely arises in station lighting circuits run in conduit, the better plan seems to be to distribute lighting current from a central bus set or cabinet, using a single set of lamps only, and depending upon the double interior service supply, combined with an emergency line from an outside source to meet unexpected demands for illumination under conditions of trouble.

Closely allied to the facility with which switching equipment can be handled is the matter of circuit diagrams, especially in skeleton form. The practice of operating companies varies greatly in this respect, but more and more it is coming to be apparent that to force the switchboard operator to depend upon his memory, at a time when judgment is the chief qualification, risks disaster. The existence of single-line drawings of two- and three-phase connections, switches and generating units, with transformers, with the normal capacity of each circuit in amperes marked upon the diagram is a help in times of stress; and more than this, if a skeleton diagram of the principal feeder circuits outside the station is available, the external handling of the system can often be greatly quickened and improved. In some cases elaborate pilot-light boards have been prepared to show the status of outside lines, but for ordinary service a simple print is sufficient. Modern switchboard diagrams have been greatly simplified by the practice of cutting short intermediate wiring and showing by numbers only the beginning and ending of wire runs to and from interior conduit sections. Too few stations are well equipped with interior and exterior-circuit diagrams, stripped of auxiliary connections. As the outside lines are handled more and more by telephonic co-operation, it will become of increasing importance to do everything possible to facilitate the mental grasp of outside conditions by employees at the station. It is not too much to say that the safety of linemen depends upon such practice in no small degree.

A third means of increasing the effectiveness of the station operation is by the standardization, so far as possible, of the types and sizes of inclosed fuses employed. In large stations the number of auxiliary motors employed continues to multiply so that anywhere from ten to seventy-five motors may be found under the roof of a single plant, let alone the number of lighting-circuit subdivisions in use. Since these motors must obviously cover a wide range of capacity, many different fuse sizes must be kept in stock; but there is an opportunity to reduce the stock if the same make and type of fuse is employed, so far as practicable, and if the sizes are cut down to the minimum necessary to perform reliable service. The cost of keeping many fuses of diverse characteristics on hand is not, perhaps, a serious objection against economical operation, but so far as the matter can be simplified, time will be saved in hunting for spare fuses in emergencies and there will be reduced danger of applying the wrong type or style of fuse in case of trouble. In any event, too much insistence cannot be placed upon the clear and complete labeling of all fuse stocks, with separation of all sizes in the storage bins.

AN AID TO HETEROCHROMATIC PHOTOMETRY.

The startling announcement recently made at a Royal Society meeting in London and chronicled in our columns this week, that an apparatus had been invented which duplicates the sensitivity of the normal eye to radiation, opens an important field for investigation and presents a valuable adjunct to heterochromatic photometry. It has heretofore been considered impossible to imitate the eye with any physical instrument which would be proportionately affected by radiations of different wave-lengths, but it is claimed that this has now been done. This sensibility curve of the human eye presents such a peculiar shape, and, moreover, a shape varying with the intensity of radiation (Purkinje phenomenon), that it was considered hopeless to try to imitate it with inanimate apparatus. The fact that the apparatus does not show the Purkinje phenomenon is one point of difference from the human eye, but a difference which makes it more valuable for photometric purposes, since it would permit of measurements at different distances from the source.

The apparatus in question makes use of filters or absorption cells containing solutions of copper sulphate and potassium bichromate, and it is found that these not only absorb all invisible radiation, but will, when in proper proportions, absorb sufficient of other wave-lengths so that the transmitted light at each wave-length is in proportion to its visibility. The energy transmitted is therefore proportional to the visual impression, and by measuring it we have an index of the value of the source for illuminating purposes which is free from all personal equation. It thus avoids many of the difficulties which have heretofore beset heterochromatic photometry.

The author of the paper, Dr. R. A. Houstoun, suggests the use of this apparatus in defining the unit of light intensity, but little or no advantage is to be obtained in this way. The principal value of the apparatus will be for laboratory comparisons of sources of different color, which by its means can easily be compared also with any fundamental standard. Other methods of defining a fundamental standard exist which are preferable in that they are more exactly reproducible. The existence of such apparatus suggests the possibility of a monochromatic standard.

Mississippi Convention Program.

The third annual convention of the Mississippi Electric Association will be held at Gulfport, Miss., June 20, 21 and 22. The morning session on Tuesday, June 20, will be devoted to an address of welcome by Judge J. H. Neville and the address of President S. W. Greenland. At the afternoon session there will be papers by A. B. Paterson on "Relation of Employees to Company and Public"; by J. N. Eley on "Modern Street Lighting"; and by L. Callender on "Electrically Heated Appliances."

On Wednesday there will be papers by D. R. Tomlinson on "Economy of a 750-Kilowatt Engine"; by Edmund Dreyus on "Steam Turbines"; by A. H. Jones on "Necessity of Commercial Department"; by Jack Abbot on "Care and Maintenance of Street Cars." C. E. Reid will open the Question Box.

The entertainment features include a reception and dance on Tuesday evening, a car ride and banquet on Wednesday, and a boat trip to Ship Island on Thursday.

Iron and Steel Institute.

At the meeting of the Iron and Steel Institute held in London last month, a number of interesting papers were read. Among them was one by J. N. Friend and J. H. Brown, on "The Action of Aqueous Solutions of Single and Mixed Electrolytes upon Iron." It is known that there is a critical concentration for most solutions at which corrosion is a maximum, and that the presence of potassium bichromate prevents corrosion, in the absence of other salts. In the presence of other salts, however, potassium chromate is found to give better protection. Since boiler feed water is seldom pure it is recommended to use ten pounds of the latter salt per 1,000 gallons of water to prevent boiler corrosion. No harm is done by using a greater concentration than this, but the effectiveness is not increased.

In a paper on "The Influence of Impurities on the Corrosion of Iron," John W. Cobb interprets his results on the basis of the electrolytic theory. Corrosion is regarded as depending on the contact of pure iron and a conducting impurity connected by an electrolyte. Continuance of corrosion requires the escape or oxidation of the polarizing film of hydrogen.

Pure iron is electropositive to most impurities—that is, a current is found to flow through the liquid from iron to impurity, the iron going into combination with some substance in the liquid and the impurity remaining undissolved. Among such impurities were found phosphide, sulphide, carbide, oxide, and silicate of iron. With carbon (graphite) the effects were particularly marked. All the iron alloys tried (excepting ferro-manganese) were also electronegative to pure iron. With the sulphide and silicate of manganese little or no current flowed, because both were non-conducting. Manganese and ferro-manganese were found definitely electropositive to iron, manganese going into solution, while iron remained undissolved. Every piece of commercial iron showed electrical effects with any other, and the effects between portions of the same piece were always sufficient to induce corrosion when the other conditions were satisfied. The presence of an impurity determines so many corrosion centers for iron, and so its influence depends more on quality and distribution than quantity; thus a more homogeneous iron, even if chemically less pure, may be more highly resistant to corrosion.

H. C. H. Carpenter reported on "The Growth of Cast Irons After Repeated Heatings." He showed that phosphorous tends to diminish growth. If 0.3 per cent is present, growth is lessened by about 3 per cent. Higher percentages tend to diminish growth still more. Sulphur is never present in commercial cast irons in sufficient quantity to have more than a small influence on growth, which is, however, in the direction of retardation. Manganese retards the rate of growth in all cases, and diminishes the absolute amount in the majority of cases.

Dissolved gases have no influence on the growth of an iron containing more than 3 per cent of silicon; between 1.75 and 3.0 per cent of this element they may cause a growth of from 1 to 2 per cent. Their influence is most potent when silicon does not exceed one per cent, and in such cases they may be responsible for a growth of at least 10 per cent.

An alloy containing 2.66 per cent of carbon, 0.587 per cent of silicon and 1.64 per cent of manganese, showed no signs of growth after 150 heats, but contracted about 0.13 per cent. It is a tough material and its mechanical properties were improved by the heat treatment.

A paper by E. Colver-Glauert and S. Hilpert treated "The Magnetic Properties of Some Nickel-Steels." The conclusions reached are as follows:

A five-per-cent nickel-steel is hardest (magnetically) when quenched in the neighborhood of 900 degrees centigrade. Quenching from higher temperatures results in a softer material.

The changes which occur during the thermal treatment of a 25-per-cent nickel-iron alloy are of a far more complicated nature than has previously been thought. At high temperatures there probably exists a product which may be preserved by rapid quenching and is then strongly magnetic, and persists to the temperature of liquid air. This product does not exist in the region between about 600 and 900 degrees centigrade, but another which is also magnetic, can possibly occur at about 300 degrees. There is very little connection between the magnetic properties and metallographic structure. There is no sharp magnetic-change point for this alloy below zero, but the permeability gradually increases as the temperature decreases from about —50 to —180 degrees centigrade.

The magnetic properties of a 33-per-cent nickel-iron alloy are only very slightly affected by thermal treatment.

There is no connection between magnetic properties and microstructure.

There is no evidence that if gamma-iron exists it is non-magnetic.

The microstructures of commercial nickel-steels are practically the same as those of meteoric iron.

Toledo Section A. I. E. E.

At the annual meeting of the Toledo Section of the American Institute of Electrical Engineers, held recently at Toledo, O., officers were elected for the ensuing year. These are as follows: George E. Kirk, chairman; J. Gilmartin, vice-chairman; Max Neuber, secretary-treasurer; John J. Duck, chairman of membership committee.

Telephone Merger Planned.

According to a statement made by Theodore M. Brush, a director of the Home Telephone Company, of Albany, N. Y., negotiations are pending for the merger of all the independent telephone companies of New York State with another company, which is probably the New York Telephone Company.

John F. Gilchrist.

In a felicitous address respecting the opportunities of the Commercial Section men of the National Electric Light Association, upon the occasion of the Commercial Section banquet last Thursday evening, Secretary Martin alluded to the conspicuous success that had attended at least two of the Association's most esteemed members—two men who had made their start and carved their careers largely as commercial men in their respective organizations. One of the men thus referred to was John F. Gilchrist, last year first vice-president and now president of the National Electric Light Association.

JOHN F. GILCHRIST,
President of the National Electric Light Association.

John Foster Gilchrist was born in Chicago, Ill., March 14, 1868. He was educated in the public schools of Chicago, and in the law department of Lake Forest University. His entire business training has been in connection with the old Chicago Edison Company and its successor, the Commonwealth Edison Company. He entered the service of the Chicago Edison Company in 1887, and it is due entirely to the thoroughness with which he has approached and completed every task set before him that he has won for himself the position of assistant to the president, one of the most important positions in the central station field, calling for resourcefulness, energy, and ability of the highest degree. Mr. Gilchrist is also secretary of the Economy Light & Power Company, of Joliet, Ill.; treasurer of the Federal Electric Company, and the Federal Sign System; and second vice-president of the Illinois Valley Gas & Electric Company.

Mr. Gilchrist's rise to the presidency of the National Electric Light Association has been one of gradual and steady development. For a long time actively engaged with various committees, he has served successively as secretary and treasurer, second vice-president, and first vice-president. He is the author of a number of papers on various subjects and has contributed several papers which have been of specific importance. His paper on "Electric Signs," read before the Atlantic City Convention in 1906, was comprehensive in the extreme and was effective of a most desirable stimulus to electric sign business throughout the central-station industry. More recently his work upon rate research has given us a much clearer conception of many mooted points and the clarity with which a multitude of matters has been enunciated stamps Mr. Gilchrist once again as a man of wisdom mature beyond his years and a general of inexhaustible resourcefulness.

Mr. Gilchrist is an associate member of the American Institute of Electrical Engineers, a member and past director of the Illuminating Engineering Society, and a member of the Union League, Chicago Athletic, Chicago Yacht, Homewood Golf, and South Shore Country Clubs in Chicago; the Industrial and Engineers Clubs in New York. Mr. Gilchrist was married in 1896 to Miss Emma Lock Boyd, and is blessed with a family of two children.

Mr. Gilchrist takes an active interest in community affairs and is a valued member of several important municipal committees engaged in civic betterment projects in the city of Chicago and vicinity.

A Proposal for a Fundamental Standard of Light.

At a recent meeting of the London Royal Society a paper on this subject was read by R. A. Houstoun. The author stated that a thermopile could not be used for the measurement of candlepower because it gave the same value to the energy of every wave-length, invisible as well as visible. The author, however, had found by spectrophotometric investigation in the ultra-violet, visible, and infra-red parts of the spectrum that, if a filter consisting of aqueous solutions of copper sulphate and potassium bichromate of a particular strength in glass cells be placed before the thermopile, then this filter stopped the ultra-violet and infra-red entirely, and let through a fraction of each wave-length in the visible spectrum proportional to its visibility. In other words, it weighted each radiation according to its visibility. The voltage of a tantalum lamp was carried over a wide range, and its candlepower as read by thermopile and filters agreed well with the readings of a photometer. Owing to the high sensitiveness of the galvanometer required, the method was not suitable for commercial application, except perhaps for integration photometry, when a number of thermopiles might be connected in series with the one galvanometer. The importance of the method lay in the fact that it provided a satisfactory basis for heterochromatic photometry independent of the Purkinje phenomenon at all intensities. The author therefore proposed to use it for defining the unit of light intensity. He would define the latter as that source, the total intensity of radiation from which at a distance of one meter after passing through his filters would be 0.8 ergs per square centimeter per second.

Copper Exports.

Exports of copper during the month of May amounted to 26,655 tons, as against 28,832 tons for May of the preceding year.

Plans have been made for celebrating the thirtieth anniversary of the Paris Electrical Exposition of 1881.

The National Electric Light Association.

The Thirty-Fourth Convention, Held at New York City, May 29 to June 2—Papers and Discussions Before the General Sessions, and the Technical, Commercial, Power Transmission and Accounting Sessions—Convention Notes.

In point of attendance the thirty-fourth convention of the National Electric Light Association, which was held in New York City, May 29 to June 2, was an unparalleled success. Despite the many attractions afforded by the great metropolis, there was an extraordinarily large attendance at the sessions. These sessions were notable for many other things besides attendance, and upon the following pages it will be attempted to chronicle the leading features of the various sessions, which will include abstracts of the more important papers, a commentary upon the principal points brought out in the discussion and some descriptions of or allusions to the social and entertainment features which enlivened both the days and nights of the convention season.

In last week's issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN there was published a comprehensive review of the first and second general sessions, and the first sessions of the technical and accounting sections. The chronicle which follows, therefore, will deal with the remaining sessions of the various sections.

THIRD GENERAL SESSION.

The third and concluding general session was called to order by President Freeman at 2:30 p. m., Friday, June 2. The first paper was presented by H. M. Byllesby, entitled "Breadth of View in Public Utility Appraisals." Mr. Byllesby is the controlling head of thirty-five electrical and gas companies in the South and Southwest, and his views upon this important subject are of peculiar interest at this time. One of the striking notes in Mr. Byllesby's remarks was his declaration that the more public utility companies are understood the greater will be the respect they enjoy from the people.

"The tendency of the times," said Mr. Byllesby, "is more and more towards a strict accountability in all corporate matters. The companies represented in this Association almost uniformly have done their part to aid in a better understanding between the public and themselves and in loyally endeavoring to conform to the methods desired, granted only that along with the methods demanded by the spirit of the times, the corporations themselves receive adequate and proper protection.

"This being the attitude of all of us, and having acknowledged to the full last measure our errors of ignorance and our errors because we have been human, in the past, I think it is now obligatory upon the public, the press, the magazines, the law makers and the law administrators to come forward and co-operate with us to bring about a condition of far better feeling.

"I believe there is coming a condition of mutually better understanding than has existed in the past and which will permit continuance of the rewards which are absolutely necessary to enable this business to proceed with its heretofore energy and enterprise, labor and capital—to enable these corporations to serve the public with an increasingly better class of service and in general a continual lowering scale of charges, although of course the lowering of charges cannot go forward indefinitely.

"If public service corporations are dealt with fairly and are properly protected, I am confident they will continue to do their part. In this fair dealing and in this protection a very necessary feature is that there shall be on the part of the public and the organic channels through which the public expresses its opinion, a proper appreciation of the enormous service rendered by the public service corporations; a proper protection extended to them, and through profit-sharing stock or increasing return upon the capital invested, a reward provided which will justify the corporations in continuing to extend into thin and non-paying fields.

"Rates charged for service should be sufficient to enable the corporations while paying the proper rate of wage for the high-class labor they require, to provide for their employees when suffering from accident; to begin at least provision for old-age retiring payments as rewards for faithful and continuous service and to do all those things which the advancement of civilization requires should be done in equalizing the rewards of capital and labor and in producing a condition of better understanding between employer and employee."

Mr. Byllesby urged the greatest of care in the appraisals of public utility plants for rate-making purposes, pointing out that the estimates of engineers for the construction of new enterprises had been generally far below the actual cost of the work; in some cases as much as 100 per cent. He contended that if engineers err in their estimates prior to construction, they are subject to error also in estimating the cost of completed work.

Mr. Byllesby, as chairman of the Committee on the President's Address, reported that the committee unanimously recommended that the president's address be accepted without alteration of any description and that the thanks of the organization were due to the president, secretary and other associates for the marvelous work which had been accomplished in the past year by the organization. Upon motion the report of the committee was accepted.

The discussion of Mr. Byllesby's paper was opened by Samuel Insull, who stated that Mr. Byllesby had dealt with the subject of appraisal of properties from what might be called the engineering or professional point of view. Mr. Insull said that in discussing this subject with members of the organization, what impressed him more than anything else was how few of the managers of electric light companies have a correct appreciation of the real capital invested in the business and consequently the value of the property they are running. With respect to the financial side of the subject, with the capital side of the question, the best investment that any manager could make is to find out where he stands, to take stock of the property, not to attempt to do it himself, because he has not had the experience that will enable him to form a correct conclusion, but to call in an outside expert and pay him his fee to tell him exactly the value of his property. In dealing with the question of rates, in dealing with relations with the community, in dealing with relations of different local bodies, if one knows exactly the value of his property he will find that he can make a trade that will give a satisfactory return on the capital invested.

The paper entitled "Elements Affecting the Fair Valuation of Plant and Property," by W. L. Wells, of Brooklyn, was presented.

VALUATION OF PLANT.

This paper discusses the various elements which enter into the valuation of a public utility on the basis of both cost and reproduction, and the classification of accounts ordered by the New York Commission is given in an appendix. Methods of distributing depreciation over the life of the equipment are denounced as illogical, and the author favors taking the entire replacement value from current revenue at the time the replacement is made.

In opening the discussion on this paper Henry Floy said that before intelligent discussion of these questions could he had we must agree upon what the terms we are to use must be. In his opinion the term "service value" should indicate the value of the property rather than the "wearing value." In determining depreciation we must agree on the basis of that depreciation. Depreciation naturally divides itself into two classes; one that he would call

"absolute" depreciation, and the other "theoretical" depreciation. Absolute depreciation may include aging and obsolescence. That may be uniform, or it may not move in a straight line. Theoretical depreciation has nothing whatever to do with the value of the property to the corporation in rendering the service to the public, and should in no sense be considered in determining rate cases or capitalization cases. It seems to him that the Association, public utility corporations, consulting engineers and manufacturing companies should unite in securing data as to the life of the various classes of apparatus.

Dr. F. H. Peckham indorsed Mr. Floy's remarks and suggested the appointment of a special committee to make a special inquiry into this subject to report at some future meeting.

John W. Lieb, Jr., emphasized the importance of operating companies taking into consideration the depreciation factor, particularly as it affected the attitude of mind of commissions in rate-making controversies.

The paper was discussed by A. S. Miller, F. H. Abell, J. B. Klumpf, and J. W. Alvord, and particular stress was laid upon the inadequacy of the expression "intangible value," and also upon the urgent necessity of establishing a definite appreciation of the value of a corporation as a "going" concern.

The chairman explained that the Committee on Terminology had largely heretofore confined itself to technical terms, but that it may be thought wise to include within its scope the determination of other definitions as pointed out in the present discussion. Otherwise the Executive Committee might take the matter under advisement.

The report of the Committee on Rate Research was presented by John F. Gilchrist, chairman.

RATE RESEARCH COMMITTEE.

The Committee has made a careful study of the rate schedules now in use in the country, of the effect of general use of high efficiency and long-life lamps upon income, and considers it desirable to encourage more uniform methods of fixing rates and more uniform rates than now exist. In spite of the present non-uniformity, the actual cost is not widely different to large consumers. The report is largely taken up with an explanation of a geometrical method of representing rates on the three-charge system, as given by H. E. Eisenmenger in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for February 11, 18 and 25, 1911. This is applied to the more usual systems where energy consumption and maximum demand (or its equivalent in the form of connected load, floor area, number of rooms, etc.) are the two elements considered. A multiple-rate system is shown to involve the three elements of charge, and examples are taken from the schedules in use in Boston and Chicago. The rates in Denver, Lowell, New York, Minneapolis and Baltimore are also represented.

Rate-regulating bodies are now principally concerned in the maximum rates charged, which apply to most of the customers—65 to 75 per cent. These yield, however, not more than 15 per cent of the income. It is with this class that the greatest lack of uniformity in rates exists. The Committee urges that rates for this class of customers be made rational and more uniform. The Committee is of the unanimous opinion that the charges for residence business should be no more than sufficient to pay expenses plus enough profit to attract capital into the business, as applied to the class and not each individual customer. It is not unanimous as to whether any rate should include a minimum charge per month or per year. It is not unanimous as to whether a differential for residential business is desirable. If a differential be used, dependent upon a certain number of hours' use of the maximum demand (or its equivalent) the Committee recommends that floor area be used as the simplest, fairest, cheapest, and most easily understood method of determining such differential. Actual area or number of rooms may be used as a basis.

The presentation of this report was immediately followed by the paper entitled "Some Reasons for Difference in Price for Different Services," by N. T. Wilcox.

SOME REASONS FOR DIFFERENCE IN PRICE FOR DIFFERENT SERVICES.

In dealing with the various rates for different conditions and various classes of service, Mr. Wilcox mentioned especially the difficulty caused by the various kinds of load and by the considerable fluctuations in load. While the average load factor varies from ten to fifteen per cent, or at the best perhaps between thirty and forty per cent, the Commonwealth Edison Company, of Chicago, has by paying special attention to the most desirable load and by a suitable combination of large lighting, power and railway loads, obtained a load factor of forty per cent. The figures given in the paper are largely checked by averages obtained from recent investigations of towns with a population of between 5,000 and 100,000. The average residence customer in a town supplied from a station of between 5,000 and 6,000 kilowatts has a maximum demand of about 500 watts at each transformer. A table was included showing the essential difference in cost of plant per unit to serve both the average lighting customer and the large power customer. This table follows:

	Total investment per kw. of generator.	Annual kw. hr. at cost per kw. of generator.
Small residences..	$350 to $375	800 to 1000 kw. h.
50 kw. commercial work	225	1500
1 kw. motor, single-phase	285 to 290	3000 or more
1000 kw. three-phase	175*	3000 or more

The fact should not be overlooked that many authorities claim that in double transmission systems, including the necessary substations, the cost of residence lighting is as high as $440 per kilowatt of generator capacity. As in residence service there may be sold yearly only 800 to 1,000 kilowatt-hours with an investment of $350 to $400 as against 3,000 to 6,000 kilowatt-hours in motor service with a total investment of from $175 to $100 or even less per kilowatt. It may be seen that the variation is quite wide. In making comparisons between the cost of the average small residence customer and the large commercial lighting customer we find that the cost of a complete system required for the larger customers as well as the attendant losses are much less, so that for a fifty-kilowatt customer the complete investment per unit may not be more than one-half or two-thirds that required for the smaller customer. Local conditions vary these observations to a considerable extent, but a careful and intelligent analysis would indicate conditions, eliminate errors and prove helpful in indicating cost and discount for various services.

The chairman remarked that the value of the report of the Rate Research Committee and also the paper by Mr. Wilcox could not be enhanced by discussion, unless someone particularly desired to say something respecting these matters.

There being no discussion the session proceeded to the reading of the paper entitled "The Standardization of Electrical Selling," by Douglass Burnett.

STANDARDIZING ELECTRIC SALES.

This paper outlines a schedule for carrying on the work of the commercial department of a central-station company. One of the principal features of this schedule is a definite system of rates, taking into account all of the conditions of use ordinarily met with in dealing with the public. This rate schedule should be printed on pamphlets and obtainable at the company's office without verbal inquiry. Regarding customer's equipment, printed rules should be adopted preventing interferences with voltage regulation, requiring the balancing of three-wire and two or three-phase feeders, and providing for the classes of current available in different districts. The paper outlines the organization of a central-station selling force, by showing how each department is classified. The methods of handling house-wiring jobs, electric-sign installations, electrical household appliance orders, motor installations, etc. by the Baltimore central station are fully explained. Printed forms are used for all of these transactions, as is also the case with the company's electric vehicle and battery-charging business.

Frank W. Smith, of the United Electric Light & Power Company, New York, stated that it has been of great service to his company to let the public know exactly what different conditions with respect to rates for different classes and conditions of supply were, and also to explain very fully its rules and regulations as to service.

The paper entitled "Economies in Operation Possible Through Time Study" was presented by L. B. Webster, Marion, Ind.

POSSIBILITIES FOR ECONOMY.

The treatment of the subject taken up by Mr. Webster was founded on investigations made of the actual working time of firemen and engineers in industrial plants, power houses, etc., the data taken in this way being plotted in the form of curves. The data made use of were taken from the records of a public service corporation operating a number of light and power companies in cities of some 5,000 to 150,000 in the Middle West. The company was one which made a business of scientifically studying economical operation and finding the efficient working time of each operator. The curves show that in cases of even very good firemen only about forty per cent of the time is spent in useful work, which time might

be well employed in doing other tasks which are necessary. In one plant covered, a time study was made of the engine-room force on the following lines: The nature of the work of each engineer, switchboard man, and arc-machine tender (all receiving a higher wage than the oilers) was carefully observed and the time of starting and stopping work recorded. It was thus found that the higher-priced men were not only idle a considerable portion of their time, but in order to keep busy devoted considerable time to the work of lower paid men. In this case there was an evident opportunity for the redistribution of tasks and the elimination of some useless man. The author suggested that the time of doing various operations in connection with line work and central-station work should be standardized by careful observation of an expert crew. With this accurate data on file it would be possible to tell just how long a crew should take for each job and to hold them responsible for such work without constant supervision.

The discussion was opened by H. Fitz John Porter, the well-known efficiency engineer. Mr. Porter emphasized the necessity for establishing very careful methods in the securing of data for time study inasmuch as considerable damage could be worked both to the company and the employee if the data were not carefully selected and the men not instructed how to do their work efficiently.

Secretary T. C. Martin presented the report of the Committee on Memorials, which was adopted. This was followed by the presentation of the report of the Committee on Resolutions, which was adopted.

President Freeman said that in his opinion there had never been a convention at which the members at meetings had worked harder than at this one, and the response had been very satisfactory to the officers. Speaking for himself, he said that great as the honor of his election had been at the beginning and highly as the office was prized at that time, it yet afforded him greater satisfaction to be able to turn over his office with absolute confidence to his successor and have something else to do for a while. The honor of the presidency of the Association had always been recognized by its presidents as placing an obligation upon them of future service, and in expressing his appreciation of the support of the members of the Association he would undertake to do for his successor anything he chose as his predecessor in office had gladly done for him.

The report of the Committee on Form of Section Organization, including amendments to the constitution, was presented by Frank W. Frueauff. This report outlined several skeleton plans for constitutions for company branches, technical and commercial sections, and proposed certain constitutional amendments submitted to the Association during the executive session on Wednesday.

On motion of Arthur Williams the report was accepted.

The Executive Committee also reported the unanimous recommendation that the report of the Committee on Overhead Line Construction be received and also that any questions of policy involved in the report be referred to the Executive Committee with power for such action as may be necessary. Upon motion the recommendation was adopted.

Upon motion of E. H. Davis the plan of creating a bureau for receiving and dispensing information was referred to the Executive Committee.

The report of the Nominating Committee was then presented by John W. Lieb, Jr., and the following officers were nominated:

President, John F. Gilchrist, Chicago.

First vice-president, F. M. Tait, Dayton, O.

Second vice-president, Arthur S. Huey, Oklahoma City.

Secretary, T. Commerford Martin, New York City.

Treasurer, Gen. Geo. H. Harries, Washington, D. C.

Members of the Executive committee: W. W. Freeman, Brooklyn; C. L. Edgar, Boston, Mass.; Arthur Williams, New York City; H. H. Scott, Easton, Pa.

On motion of J. B. Stetson the secretary was authorized to cast the vote for the nominees as presented and the president declared the gentlemen duly elected.

The chairman appointed Past Presidents Frueauff and Davis to escort Mr. Gilchrist to the chair. Mr. Gilchrist received an ovation and Past-President Freeman, in presenting to his successor the gold badge of the president's office, offered his sincere congratulations and confident prediction that the coming administration would be the crowning success of the Association.

Mr. Gilchrist made a very brief response indicating his high appreciation of the honor thus conferred upon him, and Mr. Freeman, after a brief remark respecting the other incoming officers, declared the thirty-fourth convention adjourned.

Public Policy Session.

The Public Policy session was held at the New Theater on Wednesday evening, the first business being the report of the Public Policy Committee. The report first of all emphasized the fact that the Committee's conclusions may not apply with equal appropriateness to all members. Differences may exist in different communities not alone regarding financial resources and the personality of employees, but in public sentiment. The term "pension" is recommended for elimination and as a substitute the expression "service annuity" is offered. The latter is to be paid as a form of compensation for a definite service that cannot be rightly included in ordinary wages. It is a compensation for continuous service over a period of several years and is to be paid upon carefully pre-arranged and understood conditions. Any contribution, however, for the improvement of an employee's surrounding or himself are not to be included affecting him or his wage in the slightest degree. The Committee feels it important that all suggestion of charity or philanthropy should be entirely eliminated in the establishment of relations between employees and their employers. The report analyzes suggested forms of relationship, including accident insurance, sickness insurance and death benefits, service annuities, profit-sharing, employees' savings and investment funds, and life insurance. The committee recommends that any plan adopted for improving the relations between employees and member companies shall include every employee and officer from the office boy to the president inclusively.

At the conclusion of the presentation of the report of the Public Policy Committee, Mr. Insull called attention to the fact that efforts in the past had been devoted more especially to matters of new invention, improvements in efficiency of apparatus and improvements in the method of conducting the business. Notwithstanding this work the financial results have really gone to the consumers of electricity to an extent of probably from ninety to ninety-five per cent of the money it has been able to conserve through these improve-

ments. The question of relations with the public will be given greater attention in the future, and Mr. Insull thought no subject would bring greater return. Nothing can bring greater return than to devote much attention to the welfare of those who work under us. One of the greatest pleasures that can possibly be afforded to men who have the responsibility of directing large enterprises, is not that which is afforded by the money which they can make for their stockholders, but the pleasure that is afforded to them to do good to their fellows and try to leave the world a little better off when they leave it than when they came into it. In considering welfare work with our employees we have to consider that we are engaged in a monopoly business, and being engaged in a monopoly business we are subject to regulation.

There is no business where continuity of service is of such great importance as the business we are engaged in. It is a business of greater capitalization in proportion to the yearly return than any other industry. The consequence is that the interest account and the depreciation account are of far greater importance than the wage account, and in order to keep these down absolutely continuous and faithful service is necessary; and that can be obtained only by offering some incentive over the mere wage which every laborer and every man who works with his hands or with his brains is entitled to.

President Freeman announced that the report of the Public Policy Committee had been adopted at the executive session in the morning, and stated that he and General Harries had discussed these public policy questions with President Taft, who manifested much sympathetic interest in the subject. The extra session of Congress had made it impossible for the President to accept an invitation to be present, but his personal representative, the Hon. Charles Nagel, secretary of the Department of Commerce and Labor, had been prevailed upon to address the meeting on the subject under discussion.

Secretary Nagel said that the people of this country have permitted themselves to believe that everything must come to them and that we need not grapple with the social and economic problems that have disturbed other countries. We permitted the old doctrines and rules and rejoiced in our prosperity until a condition of affairs arose that no fair minded man could tolerate. Whatever plan is made must be built up soundly upon the theory that a man who is well taken care of is better than a man who is neglected. He believed that a railroad that is able to report that for a whole year by reason of its own diligence, vigilance and care it has not had a single accident, has accomplished more for the community than if it had made the lowest rate that was ever offered as a result of an order from the Interstate Commerce Commission.

He thought that the criticism that Edmund Burke had applied to Lafayette that he was the strongest man he ever knew for starting a revolution, but the poorest one for stopping it, might be applied here. The Public Policy Committee, however, had not started a revolution, but had taken a long, long step toward stopping one.

Secretary Nagel's address was received with tremendous applause and President Freeman closed the meeting by urging that the member companies establish wherever possible such of the Committee's recommendations as might be feasible in their community.

Special Session, Thursday Afternoon, June 1.

A very interesting diversion was the unannounced attendance at a special session, on Thursday afternoon, of Thomas A. Edison. Mr. Edison was received with prolonged applause. President Freeman gracefully referred to Mr. Edison as one whose deeds spoke for him, and called upon Mr. Insull to address the meeting on behalf of his old chief and intimate friend, Mr. Edison. Mr. Insull said:

Of all the honors that it has been my good fortune to receive at the hands of the industry in which we are all engaged, there is none so great to my mind as that of rising to thank you for the cordial reception you have accorded to my old chief, Thomas A. Edison. He never attempts to address an assemblage, but he wishes me to express to you his heartfelt thanks for the handsome way in which you have received him, and to assure you that he wishes you all the success that you can possibly achieve in the business in which you are engaged, and if there is one thing more than another which pleases him, it is to be informed that the same old enthusiasm which existed in the business thirty years ago exists among the generation that is now rising, which is identified with the business.

President Freeman announced that the Executive Committee, in accordance with the constitution, heartily and unanimously recommended the election, as an honorary member of the association, of C. A. Coffin.

W. H. Blood moved that the convention accept the report of the Executive Committee in recommending for honorary membership C. A. Coffin, and that a rising vote be taken. The motion was carried.

President Freeman then said: "The gentleman who has just been elected to honorary membership represents probably, as no other one does, the combination of personal interest in both the manufacturing and central-station branches of our industry. While perhaps he is best known as the executive head and guiding genius of a large manufacturing company, his personal interests in central-station work are probably as much as they are in manufacturing work, and it gives me very great pleasure to be able to present at this time to this convention our newly-elected honorary member, C. A. Coffin."

Mr. Coffin then addressed the meeting as follows:

This is quite an unexpected honor to be elected an honorary member of your society. The next greatest honor would be a regular membership in your society, a society which has had my admiration, my confidence, has been my support and help in all times of trouble, in all seasons of business depression, in all times when there seemed to be a halt in the march of electrical progress, as sometimes happens. Then suddenly one of our organization, one of our engineers, or some one of our official staff would get an inspiration from you, and the skies would brighten, and we would go on to further work, and effort, and with your help, to a measurable victory. We have appreciated the vast encouragement we have received from you, and the inspiration that we have had, and the constant upbearing, comradeship, companionship that we have had with all of you—we have not the pleasure, unfortunately, to meet you all, as frequently as we had the pleasure and delight of meeting your president and Mr. Insull and others, but we appreciate the efforts of all who have contributed in proportion to the vast opportunities they have had to the conspicuous work which stands as the work of your organization as a whole.

I will detain you only a few moments. I have especially one message, which in all my life, and especially during the busy and happy, fruitful years, in which our organization has been in touch with your organization, has been very close to me—I have often been impressed with the feeling, which I believe should go home to the hearts of every one of you co-workers, that you should be happy in and satisfied with your particular calling in life. More than that, you should be proud of it, and above both of these, you should be devoted to it. I realize that no such message is necessary from me, but I often have occasion in my own mind to compare the most interesting, fascinating work in which you are engaged with that which we call, for want of a better name, the old industries, the regular, the standard industries, and I often think if the question were asked me—Would you exchange the work to which you have put

your hand for any of these, that the answer would come promptly—No, I would not. Your problems have the fascinating charm of chance. The great and supreme inspiration of possibility, and the great satisfaction of extraordinary accomplishment in respect to adopting means to end, in contributing wonderfully, not only to the comfort, but to that which appeals more to the imagination of mankind, to the luxuries and conveniences of every-day life. Particularly can it be said of your calling, your art, that there is nothing in it of the element of humdrum, there is nothing the history of which was old yesterday, or which will become old tomorrow, or next year. There is a human touch with the household, with the cuisine, with cheerful illumination—not alone with that which appeals to the imagination, especially the fair sex, but the wonderful and effective illuminations in respect to advertising signs which are a marvel, particularly to any visiting foreigner who comes here, and to Mr. Insull and Mr. Gilchrist and his associates we owe a great debt of gratitude for the extraordinary work they have done in that art, which is not confined to that which we admire, the conspicuous element of it, but the practical element of it to my mind is that it educates the public eye to a much higher degree of illumination, accustoms the eye to greater brilliancy so that even a well lighted office or home, which seemed heretofore to be well lighted, now requires more illumination, and that is its practical side.

Transportation has become the great field of industry in modern civilization, and I often compare your vocation with that of the great transportation systems of the country, and had I a friend or a brother, or one to whom I was adviser, would I suggest that he leave the field of your work and enter that of transportation? No. That misses the personal touch, it misses the co-operation with every individual citizen, it misses that recompense for struggle and work, and the return for achievement, in a satisfied, responsive community, in which every citizen whose home you light feels that his, and her, and their children's comfort is augmented, their convenience increased, their health preserved, and contentment with life in the suburbs or on the farm, contentment with that phase of existence, has been greatly deepened and strengthened, so from every point of view I think we should all have occasion to be gratified, profoundly so, with our work, and to be proud of it and devoted to it, and it is a great inspiration to me to stand before an assemblage of this kind, and this size, each member of which represents in his own community the greatest expression of American civilization—there is no luxury greater, no convenience handier, nothing that meets more fully the wants in the everyday life of any community than what you in all the various applications of electricity already made, and still others yet to come, afford; and I want to congratulate you all, and I never forget to congratulate myself and my associates, that we have in you the support which has been a source of strength for so many years, and that you are carrying in a way our banner, doing our work, are achieving sometimes triumphs the credit for which unjustly comes to us, and I want you never to forget, and I have said it in your presence before, that we fully appreciate the duty that we owe you, for the work you are doing in our behalf, the problems you solve for us, and the suggestions and improvements which you are quicker to make than are we. I thank you, gentlemen, for your attention.

Mr. Freeman said: "We are greatly indebted to Mr. Edison for the inspiration of his presence, and Mr. Coffin both for his presence and the benefit of his words of instruction, so pertinent and eloquent. I am sure we appreciate most highly their presence, and thank them most heartily and sincerely for the favor conferred upon all of us here this afternoon."

Technical Sessions.

The second technical session was held on Wednesday morning with W. C. L. Eglin in the chair. The session was opened with the report of the Committee on Overhead-Line Construction, which was presented by the chairman, Farley Osgood. This report constituted a proposal for a national standard specification.

REPORT ON OVERHEAD-LINE CONSTRUCTION.

The final report of the Committee on Overhead-Line Construction is a voluminous document of 195 pages. The two previous reports were gone over and thoroughly revised by this committee jointly with similar committees of kindred associations. The final report is therefore submitted as the national standard of recommended practice in overhead-line construction; the committee recommends its formal adoption and the publication of this report in handbook form.

The report is in four sections, the first of which gives specifications for materials used in 2,300-volt distribution and street-lighting overhead circuits and specifications covering methods of their construction. Thirty-six pages are devoted to the material specifications, which cover wooden poles, cross-arms and pins, metal cross-arm braces, bolts, lag screws, washers, pins and pole steps; galvanizing of iron and steel, steel strand and guy rods; bare and insulated copper and aluminum wire; copper-clad steel wire, tree wire, etc. Twenty-one pages are given to construction methods, particularly pole setting and guying and the stringing of wires. Twenty-nine pages are covered with illustrations of standard materials and construction methods.

In the second section is a set of specifications covering methods of construction for overhead secondary lines, including pole wiring for street-lighting work. These are copiously illustrated, as are the following sections.

The third section contains forms for inter-company agreements and specifications for joint use of pole lines by lighting and telephone companies.

The fourth section is a joint report on specifications for overhead crossings of electric light and power lines over railroad rights of way, tracks, or lines of wires; these specifications also apply to overhead electric light and power wires of over 5,000 volts constant potential crossing, or constructed over telephone, telegraph or other similar lines. This joint report was prepared by the N. E. L. A. committee and similar committees of the American Institute of Electrical Engineers, American Electric Railway Association, Association of Railway Telegraph Superintendents, and the American Railway Engineering and Maintenance of Way Association.

The discussion was largely as to what action the meeting should take on the report. The chairman of the committee and the chairman of the meeting both insisted that some definite action be taken, whereas A. S. Miller advocated postponement until the report could be studied by the members.

E. H. Davis objected to certain paragraphs in the report, especially to clearances provided.

A. S. Richey spoke as a representative of the American Electric Railway Association, whom he had represented on the committee in considering the section on overhead crossings. He had not been consulted, however, in drawing up the section on joint use of poles, and he asked that no action be taken on that section until the matter could be considered by the American Electric Railway Association.

W. W. Freeman complimented the committee on its work, and suggested that if the meeting could not agree to adopt the report as a whole, it should be referred to the Executive Committee to harmonize the points in dispute.

George E. Wendle considered the clearances greater than were found practical in good practice.

A. S. Ives criticized some of the details, regarding the spacing of cross arms, lightning arresters and rental charges.

Farley Osgood answered a number of questions which were raised, and explained that many of the provisions were compromises between the practices in different parts of the country. He explained that the section on joint poles had been standing since 1908, and did not think that any harm could be done by their adoption, as Professor Richey feared.

Paul Spencer spoke in support of the specifications.

It was finally decided to recommend to the Executive Committee the adoption of the report, and a motion to that effect was carried.

A recess was taken until the afternoon, and the report of the Committee on Preservative Treatment of Poles and Cross-Arms was then presented by W. K. Vanderpool.

PRESERVATIVE TREATMENT OF POLES

The report of the Committee on the Preservative Treatment of Poles and Cross-arms is a document of 122 pages. The preliminary report of the committee, made at the last convention, took up more particularly the various treatments, but was a general discussion of the subject. In this year's re-

port more specific attention is given to the preservation of line timber, including definite working data and specifications. Of the various processes, the brush and dipping method has been found to be suitable for a limited number of cases where more thorough methods cannot be applied. The open-tank treatments seem to be suitable for the largest number of companies, inasmuch as the cost of the treating plant is not very great and its operation is relatively simple. The best results are obtained with the full-cell treatment, that is, by the pressure process. For this process, however, the investment in the treating plant is relatively high, and it is suggested that probably few companies would find it profitable to install such equipment. Therefore, it is recommended that where timber is to be treated by the pressure method, which is considered the standard method, that it be sent to one of the commercial creosoting companies, which do the work thoroughly and at quite reasonable cost. Durable woods, such as chestnut and cedar, can be treated satisfactorily by the open-tank process. Poles of the weaker woods should be treated for their entire length, preferably by the full-cell, pressure method. In all cases careful attention must be given to the prior seasoning of the timber.

Under the subject of preservatives, detailed specifications are given for coal-tar creosote oil and mixed oils, including water-gas-tar and distillates, which in general are less expensive than creosote oil. Under the subject of treatments, specifications are given for the high-pressure system, the open-tank or atmospheric-pressure system, and for brush treatments. These go into much detail and give methods suitable for treatment of poles and of other line material. A number of descriptions of open-tank plants are given with the aid of numerous illustrations.

In Appendix A is given an article by Hermann von Schrenk on "The Treatment of Telephone and Telegraph Poles as Practiced in Europe during the year 1910." This gives in some detail the processes that are used in various countries along with specifications for some of the treatments. Appendix B gives a series of valuable suggestions and data covering the open-tank treatment of poles with creosote. Appendix C gives the report of a company that has been making use of a creosoting plant for some time. Appendix D shows the results of eighteen tests to determine the inflammability of treated timber; these show conclusively that creosoted timber is not as inflammable as the untreated timber. Appendix E gives an extract from a bulletin of the United States Department of Agriculture on the damage to telephone and telegraph poles by wood-boring insects. Appendix F gives extracts from a bulletin of the United States Forest Service, giving the latest statistical information concerning poles, cross-arms, brackets and insulator pins purchased up to 1909; it also makes some interesting references to the preservation of such timber products. Appendix G gives a discussion by Dr. von Schrenk on the 1910 report of the Committee.

R. D. Coombs opened the discussion by asking a few questions. He thought the specification regarding knots should be more rigid.

S. B. H. Paine thought that poles having preservative treatment could be used on transmission lines in place of steel towers, especially where the right of way is limited. From every aspect except permanence the wood pole is preferable, and there is no difficulty in getting sufficient strength.

Paul Spencer questioned the use of sapwood in cross-arms.

H. A. Holdredge spoke of the difficulty to line-men arising from the conductivity of treated poles. He had stopped using treated poles where transformers are hung and at cross-overs. He also referred to the difference in European practice, where thirty pounds of preservative is used in place of the twelve pounds recommended by the committee.

W. L. Abbott spoke of treating the pole only at the ground line by inclosing it in a cylinder.

Mr. Kennedy told of experience in Southern California where experiments had been carried out in conjunction with the United States Forest Service, on different treatments for different soils. Open-tank hot treatment followed by cold immersion was found best. It is preceded by seasoning. Twelve pounds is not sufficient for all kinds of soil. Creosote and carbolineum have been tried with satisfaction. Creosoting with cold tar and then wrapping with burlap left poles in good condition after seven years. Poles surrounded with cement shelves shed the water and have remained sound. Poles should be thoroughly treated before being used for any purpose.

W. K. Vanderpool answered some of the questions. He thought it desirable to fully preserve cross-arms by pressure treatment even though it involved greater freight charges. He thought thirty pounds more than necessary in this country for poles, though it might be suitable for railway ties. Even in the South fourteen or fifteen pounds should be sufficient. Fifteen or twenty years of additional life is secured by proper treatment. It is not recommended to treat chestnut poles, and he had no information relative to Idaho cedar. Referring to Mr. Abbott's suggestion, he thought the most thorough method was to put the creosote in a jacket and seal it. He thought it unsafe to use concrete or steel poles for ordinary distribution work or arc-light circuits. Mr. Eisenhauer agreed also that poles should be insulating.

Dr. Alman closed the discussion. He stated that twelve pounds to the cubic foot had been recommended on the basis of the experience of the American District Telegraph Company, which extends over fifteen years. A creosoted sapwood arm after long exposure is in better condition than an untreated arm of heartwood. Experiments on conductivity showed that creosoted poles had higher conductivity than those treated with zinc chloride. The tests were made after seasoning for two years. The creosoted pole contained thirty per cent of moisture, the other seven per cent. Rigid inspection is necessary if specifications are to be enforced. He cited numerous instances where the specifications were not even approximated and even where sub-contracts were let on different specifications. On one army contract forty-three per cent of the material offered had to be rejected and retreated.

The report of the Committee on Underground Construction was then presented by W. L. Abbott.

UNDERGROUND CONSTRUCTION.

The report of the Committee on Underground Construction covered four main topics: conduit construction, cable and installation of same, auxiliary subway equipment, and operation. Respecting the first of these, a particular study was made of the design and construction of a conduit system for suburban districts and small towns. The first thing to be determined is whether the distribution shall be from a conduit in the street, from an interior block system, or from a conduit along the sidewalk. Each of these systems has been used under special conditions and been found satisfactory in meeting them. Of eight large companies that operated, four used tile and fiber ducts, one uses tile and stone, two use fiber exclusively or nearly so, and one uses tile exclusively. The cost of cement or fiber duct is about ten per cent less than tile duct in all sizes below twelve ducts. Above this number, however, the tile constuction is the cheaper. The use of fiber ducts is increasing.

In the second main topic considered, the Committee discusses the construction of, and material for, cable joints on systems of 6,600 volts and over. Low-tension cable joints give practically no trouble, but in high-tension work the joints frequently do. Detailed specifications are given and several diagrams of a joint that is recommended for three-conductor, paper-insulated, lead-covered cable. Paper tube joints are also used to some extent. In all joining work it is important to have a careful and conscientious splicer. Considerable attention must be given to securing a good sealing compound. Some trouble has been experienced by nearly all large companies from electrolytic action on cable sheaths. Some companies favor fiber conduits for this reason, waterproof joints being made between sections of fiber ducts. Anything exceeding one-half to one volt positive difference of potential between cable sheaths and underground metallic structures becomes serious and requires preventive measures. Various schemes are made use of to minimize electrolytic trouble, but no single one can be recommended as being the best. Some attention was given to the matter of the composition of cable sheaths and to the material and thickness of the insulation. Cables running through manholes require careful protection and separation. Unsheathed cable has been used to some extent, but is not recommended for permanent installations. Submarine cables have been giving good satisfaction, but give trouble chiefly when boats drag their keels over them or pick them up with anchors.

In connection with auxiliary subway equip-

ment the Committee considers that transformers for an underground system had better be installed on poles where the distribution is overhead or in special vaults on the customer's premises or under the sidewalk if the distribution is entirely underground. Where fuses are used they are between 150 and 200 per cent of the cable capacity.

Under the subject of operation the Committee considers the failure of cables and of joints. Respecting the former, trouble has been experienced from punctures of the sheath; some failures have occurred from proximity to steam pipes which heated the surrounding ground and the conduits; more trouble is experienced during hot weather as a rule; failures in manholes have also occurred. The chief cause of failures in joints is due to improper design, unsuitable materials, or careless workmanship, the two latter being the chief causes. In case of serious short-circuits the trouble has frequently been communicated from one duct to adjoining ones, but in conduit built with fiber or with concrete duct material having tight joints there seems to be greater resistance to the transfer of heat from a short-circuited cable. In locating troubles, the Murray loop test is most commonly employed, but the method of using an intermittent current and exploring the damaged cable by means of an induction coil and telephone is also much used. The design of a cable system for a substation ring or tandem arrangement is discussed, also various selective devices for indicating the lowering of cable insulation, particularly the Torchio-Varley system. The Committee concludes its report with a brief reference to the frequent explosions of gas in manholes, which can be reduced to a minimum by the use of ventilated covers.

Numerous questions were asked in the discussion. Farley Osgood spoke of the relation of the insulation between the several conductors of a cable and the over-all insulation, and related some experiences.

S. B. Way stated that the concrete conduit used in St. Louis, and described last year, had been tried in Joliet under adverse conditions and abandoned. It is being extended in St. Louis with satisfactory results. This conduit requires warm weather during construction. Its great advantage lies in being fireproof, and it is especially suitable for a single layer of ducts. The cost of $5,458 a mile includes necessary manholes and distribution holes. Similar work on brick or asphalt streets would cost $6,000 or $6,500 per mile. Cement covering for cables had proven very satisfactory, as it is cheap and can be cracked off when necessary to bend a cable to a new position. The covering should be kept wet for twenty-four hours.

S. B. H. Paine told of the German practice in semi-rural communities of laying cable directly in the earth, without ducts. There is no more difficulty in discovering and repairing faults than with conduits. The latter were abandoned except on paved streets. The cost is fifty per cent more than overhead-line construction. The cable is lead-covered.

E. A. Stalker also referred to this practice, which had been tried in New York for park lighting with success. Armored cable was used.

W. C. L. Eglin stated that lead-covered cable had been used in that way for suburban residence districts in Philadelphia and Washington. He also stated that the only effective way of removing gas from a manhole was to put on a false cover and force air in under pressure. The gas is then driven back. Mr. Meyer had found trouble in Newark in getting around trees, and moreover the cost of armored cable is as great as lead cable plus pipe. The laying of pipe was favored. He considered it very important to standardize underground work.

W. L. Abbott closed the discussion. Answering a criticism of fiber duct, he stated there were two kinds. One is made of wound and creased paper; the other is a homogeneous felt mass, pressed together. The latter has considerable strength. Cable trouble can often be located by inspection of manholes. Evidence of smoke or odor of burning is often detected withut lifting the cover. The Murray loop test is usually tried first and then an exploring coil.

The paper by E. A. Loizeaux on "Load Reports of An Electric System," was, in the absence of the author, read by Mr. Burnett.

"LOAD REPORTS OF AN ELECTRIC SYSTEM"

Mr. Loizeaux, in this paper, advocates very strongly the making of load reports from the regular load records of a central-station company. He gives a large number of forms that are in use by the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md. The first step in the series of records includes the daily log sheets made by the operators at the various stations and substations. These are sent to the main office where the totals are checked and entered in a loose-leaf record book. From these records the following reports are made: A daily output summary, special daily load curves and daily curves showing the consumption of special large customers. The following monthly reports are made usually in the form of load curves: the first gives the total kilowatt-hours generated and purchased; another the kilowatt-hours sent to the commercial lines; a monthly load statement includes a summary of the more important figures of the preceding reports; a graphic load record is also made and load curves showing the maximum peak and maximum output of the month and the day on which these occurred. Yearly reports are made as follows: a tabulation of kilowatt-hour statistics, peak loads, load factors, continuous reports showing the total output by years, and several other reports dependent upon local conditions. The author recommends that all these reports be drawn or printed upon regular letter-size paper so that they may be included in any of the files of the company. While advocating the making of complete reports, Mr. Loizeaux cautions against going to the extreme of making numerous superfluous reports.

N. J. Neall thought it curious that the New York Commission had not asked for such reports. In Massachusetts it is optional to file data of least and greatest load. For commission and legal purposes it is desirable to have records. There should be an Association committee on this matter.

The sense of the meeting was that the Association should endeavor to prepare standard forms for load reports. The session then adjourned.

THIRD TECHNICAL SESSION.

The third technical session was held on Thursday afternoon with John F. Gilchrist in the chair. The report of the Lamp Committee was presented by W. F. Wells. This was followed by the report of the Committee on Prime Movers, read by L. E. Moultrop, chairman.

REPORT ON PRIME MOVERS.

The report of the Committee on Prime Motive Powers includes, as subdivisions, the topics that were formerly taken up by the Association's committees on steam turbines and gas engines. It also includes for the first time a report on hydraulic equipment. In steam-turbine work it has been found that the machines themselves gave very little trouble, but the auxiliaries were subject to some criticism, not that they were unreliable in action, but that they were causing more maintenance and attention than seemed necessary. Correspondence was had not only with a large number of member companies of the Association, but also with several of the more prominent manufacturers. The comments made by some of the latter were included in the report.

Some attention was given to the matter of erosion and corrosion of the blades and casings of steam turbines. These have been noticed in isolated cases, but no definite conclusions could be drawn as to their causes. In some instances it seemed to be from the use of improper materials in manufacture. These have generally been rectified by the use of nickel-steel or other hard compositions. All of the manufacturers stated that they would furnish direct-connected exciters for turbo-generators if these were demanded, although in some cases the practice was regarded as not a desirable one. In vertical turbines of the Curtis type, the clearance has been successively increased from the first to the subsequent stages; the fastening of the intermediate buckets has been redesigned so as to make a more rugged construction and one that obviates the possibility of leaks. One company stated that erosion and corrosion did not materially affect the efficiency of the unit, but that when it had became quite marked the machine could be rebored and brass-lined, thus not only restoring it to its original efficiency, but permanently stopping the action. A bleeder type of turbine has been developed so that steam may be taken from the intermediate stages for use in low-pressure heating or any other purpose. A better knowledge of the balancing of vertical turbines has removed the troubles that this formerly gave. The Committee regards as very important that water of condensation be thoroughly removed from the steam supply of low-pressure turbines.

Some companies have found trouble from excessive pitting and other corrosion in condenser tubes, although as a rule this is confined to those companies along the seacoast that use salt water for a circulating medium. The scheme of changing the number of water passes in surface condensers has been made use of by one company that was troubled formerly from clogging of the tubes due to deposits from muddy water; it was found that the condenser could very readily be converted into a single-pass condenser which largely minimized the trouble. There seems to be little standardization of the specifications for cylinder oil for auxiliaries using superheated steam and also for step-bearing oil. For feed-water heating in steam-turbine stations the exhaust from the auxiliaries is usually ample for raising the temperature to between 200 and 210 degrees Fahrenheit, open heaters being principally used. But little attention has yet been given to the development of larger sized boiler units; the Detroit Edison Company, however, has several having a capacity of 2,300 horsepower giving apparently excellent service. Mechanical stokers are in general use in the central stations.

In the appendices to the report are given reports that were prepared either by members of the committee or by some of the manufacturers. The first appendix gives the summary of the situation regarding gas producers and gas and oil engines. These have been found to give excellent satisfaction when carefully operated in the smaller plants, particularly where the grade or fuel available is not suited for economical generation of steam. For very large plants, however, the initial investment cost is very much heavier than that of steam-turbine equipment. A long list of recent gas and oil-engine installations reported by various manufacturers is given as the supplement to the 1910 report of the Committee on Gas Engines. The second appendix takes up water-power apparatus. Some trouble has been noticed from unbalanced gates. Turbine runners have suffered from pitting and scoring, caused in some instances by the use of improper material in manufacture and probably in more frequent cases by foreign solid matter in the water. The gears of vertical turbine units that are connected to a horizantal shaft have been the source of much trouble. Impulse wheels have been giving chief trouble in connection with the nozzles. Governors have required careful attention and this has meant the employment of highly skilled labor. Simplification in governor design is sought. One manufacturer has suggested the possibility of developing a governor which is electrically actuated by change of load instead of change of speed, so as to obtain more close speed regulation. In those governors employing the oil system careful attention must be given to the oil, and to the pumps for circulating. Relief valves have been found very successful in most of the plants. Ice trouble has been experienced in many plants in the northern part of the country. In the third appendix are given the comments of some manufacturers on means for preventing pitting of condenser tubes. In the fourth appendix are given tests of two steam turbines, one operated with a single-pass and the other with a three-pass surface condenser. The final appendix gives a detailed description of means for purifying the air for the ventilation of turbo-generators.

E. E. Gilbert called attention to the necessity for clean air for the generators.

John C. Baker commended the increasing use of accummulators in connection with the governors of hydraulic turbines. This has the advantage of rendering more certain a supply of a large quantity of oil under high pressure and will permit the use of very short lines of large pipe. It is not always appreciated what a tremendous sluggishness is imposed on the governors by a long line of pipe. The bleeder type of steam turbine finds a steadily increasing demand in competing with private plants. Heating sales will be made hereafter on a meter basis, and the only way of metering is by the condensation from the customer's premises. The metering cannot be accurate if steam of high heat quality is supplied some hours of the day and low-pressure steam at other hours. Bleeding the turbine supplies the means of furnishing steam at a definite pressure and thus results in a material economy. One of the manufacturing companies is building a type of turbine in which the steam is bled between the high and low-pressure stages and carried around one of the disks of the low-pressure side by means of a by-pass valve controlled by the pressure in the heating main. He then referred to the Humphrey gas pump which has recently been developed in England and Germany, for which a thermal efficiency is claimed ten per cent higher than that obtained in the usual cycle. Units have been designed from two horsepower up to 1,600 horsepower in capacity. Great things may be expected of this new engine, and it is hoped that the committee will include it in next year's report.

W. C. L. Eglin thought that turbines had been in practical use long enough to get some definite data on the effects of corrosion and erosion. He had found that the efficiency was materially changed where the erosion is marked. In this case, the erosion was due to impurities of the water, and not to poor design. He also referred to the excessive time usually required in making even minor repairs with a turbo-generator.

W. L. Abbott spoke at length on his experiences in balancing turbines and experiments made to test out the theories on this point. He had found that that the shaft was not always thrown out on the side having the greater weight.

Roger D. DeWolf spoke of the operating conditions which a turbine of the bleeder type would meet. The electrical load could vary up to the maximum capacity of the machine and the steam load vary up to the maximum amount of steam that the turbine would pass on the high pressure side when the low-pressure side was inoperative. A machine which will automatically control the steam supply as these loads vary, will have a very wide application. The central-station companies are coming to recognize the importance of heating as a by-product in manufacturing power and with such a machine this buiness can be handled to advantage. The use of a reducing valve in connection with this work is not advisable because the turbine is itself a reducing valve, and its efficiency is decreased by the use of another valve, since some of the available heat energy is not transferred into power. He criticized the committee's report for not stating with what success gas engines have met where they had supplanted central-station service. He thought that a detailed examination would show that in the long run such plants are not successful for the small isolated-plant owner.

I. E. Moultrop spoke of the conflicting data on shrouded blades. Although it is claimed that they prevent the entrained water from being thrown against the cast-iron cylinder, other experience shows that there has been considerable wasting away of the cast iron, due to the impact of the wet steam. Speaking of improvements in design, he pointed out that the advantage of high rotative speeds was in the reduction of the rotor diameter. By dividing the steam between two equal elements in the double-flow turbine, the blade lengths are halved and therefore become practical for high speeds. He corrected a statement in the printed report regarding internal-combustion engines, and stated that such engines have been built abroad in sizes up to 10,000 horsepower, and with 1,500 horsepower in a one-cylinder, two-stroke, four-cycle engine. Regarding the effect of erosion on efficiency, he stated that the efficiency might be expected to fall off for a turbine of the Parsons type because the erosion increased the clearance over the blade tips. In the Curtis type this would not take place. Feed water undoubtedly has an important relation to erosion and the same type of machine shows very different results in different localities.

The report of the committee on electrical apparatus was then presented by G. L. Knight.

REPORT ON ELECTRICAL APPARATUS.

The report of the Committee on Electrical Apparatus covers a wide range of generating and substation equipment.

The past year has been a notable one in the development of turbo-generators of large capacity. The Commonwealth Edison and New York Edison companies have placed orders for a number of machines of 20,000-kilowatt output and it is understood that units of still greater capacity for one of these companies are under consideration. The report gives the reason for the selection of 4,500 volts as the generator voltage at Chicago, and the use of a compensator to increase the potential to 9,000 volts, for use on the lines. In the case of the Chicago machines the winding of the generators was designed to give a reactance of four per cent, and in conjunction with four-per-cent reactance in the compensators, the short-circuit current of the unit as delivered to the bus will be limited to fifteen times the normal full-load current. Several large units in process of construction for the use of other companies are to be arranged in a similar manner with a combined reactance factor in generator and compensator of about eight per cent. The report takes up the question of reactances, describing those that have been built, and declares that the tests recently made of these at Chicago show conclusively that 12,000-kilowatt generators can be short-circuited without harm when such reactances are used. Field rheostats are next considered and recommendations made that these be placed in such position as to avoid the delivery of heat to either the leads or the dial-switch heads, and a warning given that great attention should be paid to the proper securing of the leads at the rheostat as the disconnecting of a lead may lead to disastrous open-circuiting of the field.

Under the head of oil switches the report states that the large number of tests recently made at Chicago has given an unusual opportunity for studying the operation of oil switches, several types of which were used and some of which were modified in several different ways, with a special view of increasing the safe rupturing capacity with minimum damage to the switch. The Committee strongly recommends that all disconnecting switches of the knife-blade type should be mechanically locked in place, as short-circuit conditions and strains produced by magnetic fields around conductors in bus structures have in some cases been sufficient to cause the knife switches ordinarily used as disconnective switches, to open at points where the ensuing arcs have damaged everything immediately surrounding, as well as interrupting service. The report emphasizes the important duty performed by an employee of an electric generating system in the paralleling of generators for operation on a common bus. One company reports that it has developed what it calls a synchronizing recorder which records the exact position of the synchronizing needle at the time the switch is closed. The result of this record of the accuracy of a man's work causes the operators to exercise the utmost care in handling machines. The report calls attention to the troubles that have been experienced with time-limit relays of various types and voices the hope that in the near future a relay will be on the market which will avoid the troubles experienced heretofore in the operation of relays on feeders from a common source, where selective action has not been obtainable.

The question of series transformers has received careful attention. In the past the manufacturers have overlooked the enormous strains to which the windings of these transformers were subjected under short-circuit conditions, and it is only after recent experiments that the true conditions have been apparent. Examination of series transformers of small capacity which have broken down under short-circuit conditions show the primary windings to be practically disrupted. It has now been decided that for certain purposes, particularly where automatic circuit-breaking devices were operated by these transformers, under no conditions should the transformers be used with other than a single piece of copper for the primary circuit, this bar to pass directly through the transformer and to be inclosed with a single insulating medium of satisfactory strength, to properly separate the primary and secondary windings under all conditions. The general practice is now established that where accurate instrument transformers are necessary two transformers should be installed in series, the first to be of the single-turn type located nearest to the busbars and to be used exclusively for tripping switches and operating ammeters, the second to be of a more accurate type for operating recording and indicating instruments. The report calls special attention to the troubles which member companies have had with the primary fuse of potential transformers. Several new types have been developed and it now seems that for at least 6,600 volts and under the problem has been solved satisfactorily. Respecting motor-generators and rotary converters there is expressed the desirability of using, as far as possible, slow-speed apparatus. The tendency of the manufacturing companies in meeting competition seems to be to develop apparatus running at high speed, as a result of which many reports of unsatisfactory operations have been given. The report also takes up more briefly storage batteries, feeder regulators, series mercury-arc rectifiers, lightning arresters and testing of electrical apparatus, particularly of high-tension cables.

W. F. Wells brought up the question of what could be done to prevent the spread of fire in substations since in oil-cooled transformers it is often difficult to prevent fire from spreading. With air-blast transformers a fuse should be arranged that as soon as flame issues from a transformer the blower would be automatically shut down.

F. D. Newbury spoke of the design of turbo-generators. A feature that should be carefully watched is the coil bracing. Effective bracing will limit the damage possible, and the use of rope as a restraining means should be avoided as far as possible. Since high-speed machinery is cheaper than low-speed mechinery it should be adhered to, and by properly inclosing noise has been obviated. He depreciated the input-output method of measuring efficiency, since the result depended upon the difference between too large quantities, and stated that the only accurate method is to measure with integrating instruments over a long period of time with constant load.

R. F. Schuchardt stated that the tests made in Chicago have been completed and the conclusions given in the report not materially changed. They had more confidence in oil switches than formerly, as tests showed that the switches would do more than they had been thought capable of.

E. M. Hewlett spoke of the difficulties with time relays and of some new designs which are being developed. He stated that he had a potential-transformer fuse which can open a large system under any condition of short-circuit without distress.

I. E. Moultrop thought that motor-generator sets should be tested individually before being shipped from the factory. The large manufacturers make careful tests on one machine of a type and then assume that they will all act the same way. He favored the input-output method of testing. He stated that although time relays had been set differently, he found that they all came out together whenever trouble occurred.

H. L. Wallau stated that he had somewhat the same conditions to contend with in Cleveland, where they operated with a neutral and used a limiting resistance. When there was a ground he got a selective action, but with a short-circuit all the relays went out at once.

The next paper was on "Ventilation of Turbo-Generators" by R. B. Williamson.

VENTILATION OF TURBO-GENERATORS.

Mr. Williamson's paper points out the need of cooling turbo-generators and some successful ways of doing so. The high speed of these machines makes them small in bulk and their high rating means the concentration of great heat from the friction and core losses. To prevent dangerous temperature rise, forced cooling is necessary and usually carried out by circulating air through the inclosed machine. About 125 cubic feet of air per kilowatt of internal loss should be provided. In a typical 5,000-kilowatt, 1,800-revolution-per-minute machine the losses were: Friction and windage, 120 kilowatts; core loss, 78; copper loss, 45; or a total of 243 kilowatts; this machine therefore required about 28,000 cubic feet or 2,270 pounds of air per minute for cooling. Another rule for determining the amount of air required is to provide 5.0 to 7.5 cubic feet per minute per kilovolt-ampere output. On this basis the weight of air needed in many cases exceeds the weight of steam passing through the turbine. In order to pass this large quantity of air attention must be given to the ducts or pipes through which it is led. The air must be cool and clean. If cool air cannot be obtained from the basement, it should be drawn through a duct from outdoors. The velocity in these ducts should not exceed 1,200 feet per minute. A small percentage of dust would soon produce a large deposit of dirt in the machine, therefore an air filter should be used. This must be cleaned frequently to prevent fouling and stoppage of the air supply. Various forms of filter and arrangements of the generator casing were described and illustrated. It has been suggested to utilize the heated discharge air, as its heat represents

from three to six per cent of the station output. It is customary to set up the air circulation by means of centrifugal fans at the ends of the rotating field, although sometimes a separate centrifugal blower is provided. The greater part of the cooling air is required for the stator. At least two different arrangements of air passages are provided in different machines. One has the air entering through the end housings, passing through the fans to a chamber at the base of the stator yoke and then through the stator core ducts to the discharge at the top of the machine; for very large machines the air is passed through multiple paths leading through numerous inlets in the periphery of the yoke, then through the stator core ducts and out at adjacent outlets.

H. L. Wallau called attention to the fact that where the air circulates through a station basement, through the machine and back again, there is a great tendency for dirt to collect in the machine. If the dirt is simply blown out it is spread around the station and eventually gets to the generator again. He thought a vacuum system of cleaning would be desirable.

R. F. Schuchardt stated that a vacuum system was being installed in one of the Chicago substations, but he did not know of any application to generators.

The next paper was by M. O. Troy and was entitled "Progress and Development of Self-Cooled Transformers."

SELF-COOLED TRANSFORMERS.

The question of limiting the size of self-cooled transformers, Mr. Troy stated, was purely one of temperature, and therefore the development of the transformer has been concerned with the solution of thermal problems. Speaking of the early development, between the years 1885 and 1890, the author mentioned the fact that the first transformers were very small and that for this reason there were not serious difficulties with excessive temperature. When oil cooling came in, about 1890, the cooling effect was not at first realized and then the transformers were made in only small sizes so that it was not uncommon to see transformers clustered over the exterior of a building. At the present time, owing to better cooling, the core-type of transformer, or the newer type, the distributed core-type transformer, has come into very general use. This type has its core divided into four external parts resulting in a reduction of the average length of magnetic circuit. The central leg on which the windings are placed has a restricted cross section which considerably reduces the length of the copper windings. Greater efficiency, better insulation and greater rigidity are among the advantages of this type. The first transformer of this type was built in 1902 and the transformer was finally put on the market in 1907. Since then other improvements have been made and there is now a constant striving to bring down losses and to approximate as nearly as possible an efficiency of 100 per cent. The life of a transformer is, perhaps, even more important than a small increase in efficiency, and although further refinements may increase efficiency, the future transformer improvements will probably be largely made in the direction of securing a longer useful life. Power transformers, Mr. Troy stated, were even more rapidly developed than distributing transformers. Oil cooling was introduced as well as the further refinement of water cooling, through pipes in which water circulated. It is, of course, possible to work the copper harder in the water-cooled transformers, reducing the amount of copper required for a transformer of given capacity. An increase of cooling surface was, as an improvement, obtained by spreading the coils apart at the end of the core. In some cases ducts were provided between the windings. As the size of a transformer increases it is not only necessary to make the tank large enough to contain the coils but there must be an increase of surface to dissipate the heat. Mr. Troy's paper ended with a review of the leading types of transformer tanks now on the market.

A. S. McAllister pointed out that the true radiating conditions were not altered by changing the shape of the surface, but that the real gain was in the increased convection of heat by air currents.

W. S. Moody replied that this was merely a matter of definition and that the term "radiating surface" was popularly used for the entire effect, although it was not strictly correct.

The session then adjourned.

Power Transmission Section.

The first meeting of the Power Transmission Section was held on Thursday morning with John F. Gilchrist in the chair. A report was presented by A. S. McAllister on the April conference of the section, where water powers and their governmental control were discussed.

A paper was then presented on "Central-Station Power and Electricity Supply for Trunk-Line Railroads," by Frederick Darlington, of the Westinghouse Electric & Manufacturing Co.

CENTRAL-STATION POWER FOR RAILROADS.

Mr. Darlington's paper points out that power for all purposes, including electric lighting, manufacturing and railroad motive power, should properly be supplied from the same central stations and that power generation and railroading should be conducted as separate and independent undertakings and not by railroad companies engaging in central-station power work. There is one essential to railroad work that must be met to the fullest extent before central stations can hope to succeed in the general supply of electricity for railroad motive power. The power must be reliable and the railroads must be assured of its continuity of service under all circumstances. This implies a degree of permanency and a simplicity of construction that has not been generally attained, according to Mr. Darlington. In this connection comparisons are made between large and small-capacity plants, the former being shown the more reliable and economical. Figures are also given, showing total installation cost per horsepower of large and small plants. The author then likens the locomotives of a railroad to so many poor portable steam-engine plants of 1,000 to 1,200 indicated horsepower. Steam locomotives by the very nature of their service are tied down to pretty nearly all of the conditions which are recognized as objectionable in stationary, power-generating plants. They have to be operated non-condensing, fire-box space is limited, have poor average load-factor, etc. On the other hand the advantages of the electric locomotive were cited. The paper calls attention to the attitude of some in talking of the great cost of electric power on railroads and referring to the existing installations in this connection. As a matter of fact the instances where electric locomotives have hitherto been installed on trunk lines have all had for their main object the avoidance of smoke in tunnels and the sections electrically equipped are not favorable to the most economical operation. To install an entirely new motive-power system for a few miles only must always be disproportionately expensive. The author states that under suitable conditions electrification of trunk-line railroads is advisable, in many places, for purely economical reasons, whereas, in other places, where the density of traffic is small and the distances to be covered are great, electrification is not advisable. Central stations, however, should begin by furnishing the railroad power where it is economical and profitable to use electricity. As a general plan for obtaining this business in the future, Mr. Darlington suggests the unification of power systems in territories where it is possible.

F. B. H. Paine opened the discussion by stating that central stations have been negligent in the matter of supplying small electric railways and he thought plans should be made for acquiring this kind of load. Preparation for large work has come from a federation of the smaller organizations. He illustrated the case of a transmission system in Central New York which did not develop any power, but bought it from the generating companies and sold it to consumers. By having a number of sources of supply much better continuity of service had been secured. He prophesied great things for this scheme in the future with a steadily increasing load-factor.

R. F. Schuchardt agreed with the preceding speakers and pointed out the great advantages, from the point of view of conservation, by such consolidations and centralization.

The report of the Committee on Protection from Lightning was then presented by B. E. Morrow.

PROTECTION FROM LIGHTNING.

The report of the Committee on Protection from Lightning as usual is divided into two parts, the first relating to transmission systems and the latter to distributing systems. The Committee secured from about twenty companies, that have made a particular study of the subject, a summary of their results and opinions. The principal difficulties experienced on transmission systems are those arising from line failures such as breaking down of insulators, burning off of wires or poles by direct lightning strokes, etc. Where failures of station apparatus due to lightning have occurred it has frequently been found that the insulators had previously been weakened or strained by heavy overloads, and but for

this fact it would have withstood the unusual stresses not taken care of by the lightning arresters. The older types of multigap and horn arresters give fairly satisfactory service for their limited applicability. The electrolytic type of arrester has given very satisfactory results. Every installation has reduced both the interruptions to the service and the cable punctures by large percentages. The electrolytic arresters are rapidly replacing those of the horn type. The principal objections urged against are initial high cost and the necessity for frequent charging and attention. Transmission lines having overhead ground wires suffer the least damage. Special devices, such as a grounded metal ring about each insulator and an individual lightning rod at each pole, have also proven quite satisfactory in certain special cases. A device known as an arc suppressor is being developed for the relief of transmission-line troubles due to an arc around the insulator. Choke coils are generally found to have a definite value.

From these findings the Committee recommends the following respecting the protection of stations for transmission systems: Where all lines leaving a station are operated separately, each of them should be provided with an arrester placed on the line side of all apparatus. Where two or more circuits are connected to a common bus, a single arrester may be installed. Choke coils should be placed on every circuit leaving the station. The newer and improved types of insulation for transformers and other apparatus on the high-tension system should be used. If the station is already equipped with multigap or horn arresters that give satisfactory service, no change is probably needed. If these devices do not protect to the extent that they should, an investigation should be made to see whether they are installed properly and whether they actually operate. If an important station has not any protective devices and is exposed to lightning disturbances, the electrolytic type of arrester is recommended. Respecting the protection of lines, the Committee recommends the use of superposed ground wires. These should be grounded at every supporting structure, whether pole or tower. On wooden pole lines the use of lightning rods is recommended at each pole, or at least at each exposed pole.

The Committee's investigation in regard to distributing systems show that lightning arresters do not reliably protect any apparatus which is more than 400 or 500 feet away. Where the spacing of arresters is about 2,000 to 3,000 feet the losses of arresters varies from 0.07 to about 0.7 per cent of those installed, while if the spacing is one mile the losses run as high as three per cent. The cost of the average lightning-arrester installation is about $6. The depreciation is about twenty per cent. The Committee again recommends the grounding, spacing and inspection, as well as the recording of results obtained, which had been previously recommended in its prior reports. It also suggests that electrolytic arresters should be given the attention that they require.

The discussion was opened by C. P. Steinmetz, who spoke of the great advance made in recent years in protection against lightning and the design of protective apparatus. We now know how to secure protection and the only question is the economic one as to how far we wish to go in securing it. To give reasonable protection the protective device must be close to the protected apparatus. It is therefore a question whether we should not merely aim to protect the apparatus connected to the circuits and not aim to protect the circuits themselves. Local disturbances do no harm to the distribution line. In substations some form of multigap arrester is desirable at the individual transformers. Considering the theoretical side of protection, he said that the fundamental relations were of a simple nature, although a large part of the theory is highly mathematical. Every electric circuit has a natural impedance which in overhead lines usually lies between 400 and 600 ohms. This represents the ratio between voltage and current for the transient disturbance. The maximum voltage on a transmission line is limited by the spill-over voltage of the insulator. Knowing that and the impedance gives us the maximum discharge current. For 100,000 volts and 400 ohms this would be 250 amperes. This must be provided for in the discharge capacity. Conversely, if we know the short-circuit current in a flashing arc we can find from that the maximum voltage which may be produced. The natural impedance of a circuit is the square root of the ratio of inductance to capacity. Wherever a circuit changes, as at the coil of a transformer or the connection of an overhead line to an underground cable, the voltage and current of a disturbance are transformed in a fixed ratio. This ratio is the square root of the ratio of the natural impedances of the two circuits. Thus, in a step-up transformer much higher voltages appear than at the source of the disturbance.

E. E. F. Creighton discussed the care of aluminum lightning arresters. For inexperienced users the best method of determining the condition of the arrester is to place an ammeter in series with it when charging. The current will have a value depending upon the frequency of the circuit, but at sixty cycles it should be about one-half ampere, when the film is in good condition. On some transmission systems, especially hydroelectric systems, the potential sometimes rises to as much as 175 per cent of the normal potential. While the aluminum arrester can discharge heavy currents at abnormal voltages, it cannot be designed to discharge the power of generators. Hence, this condition should be avoided. Cases of trouble sometimes arise from spots on the aluminum film which finally result in a short-circuit. Trouble sometimes arises from adding new plates to old arresters when the line voltage is raised. This should never be done, as two cells which have not received the same usage do not operate well together.

William B. Jackson emphasized the necessity for good insulation of apparatus, which diminishes the need for lightning arresters. The discharge through arresters is often the source of undesirable disturbances on the line. In the last five years he had known of but three cases of breakdown of substation oil transformers from lightning. All other breakdowns were due to moisture or defective workmanship. He thought some of the money spent in protective apparatus would be better spent on insulation.

H. B. Gear spoke of the economical spacing of arresters. Attempt had been made in Chicago to get definite records under different conditions, but the area was so small that the results could not be relied upon. In addition to the most economical spacing, interruption to service must be considered. Professor Creighton has developed a new arrester which will be experimented upon in Chicago, the cost of which is only half that of the forms now available. They can therefore be used more liberally.

Farley Osgood thought that lightning arresters were used too generously and that they would be even less necessary now that the grounding of secondaries was to be made universal.

Percy H. Thomas agreed with Mr. Jackson on the question of insulation. He considered it a menace to the line every time an arrester discharges. He compared the characteristics of the electrolytic arrester with the multigap series-resistance arrester. Each is suited to a particular use. They have almost opposite characteristics. The electrolytic arrester discharges frequently and it is almost impossible to build up voltage upon it. It passes large quantities of energy; it has a large electrostatic capacity, and on discharging subjects the system to a shock similar to grounding. This shock often punctures the insulation of series transformers and other coils in series in the circuit. The electrolytic arrester is expensive and especially adapted to high potential. It requires the greatest care and constant attention. It must be level, the electrolyte just right with oil on top, and it must be charged regularly. The result of its failure is likely to be a shut-down of the system, resulting from

heavy short-circuit. The multigap series-resistance arrester discharges through a resistance which limits the discharge. It does not ground the line suddenly, but lowers the voltage gradually, and consequently does not pass off an abrupt surge quickly enough. As the voltage goes up the series resistance must also be increased and lightning finds more and more opposition with higher voltage, soon reaching a point where this arrester cannot compete with the electrolytic arrester. On voltages up to 30,000 it has given excellent service. It requires little attention and when it fails the result is merely the melting of a fuse or the burning out of the series resistance. He spoke of the scheme for shunting out a ground or arc on a transmission line as one of great promise.

Paul M. Lincoln spoke of other ways of taking care of lightning than by arresters. One of these is the underhung insulator with a grounded portion between the line and the support. The second is the use of the ground wire above the transmission line. The third is the grounding of the neutral wire on the secondary and primary distribution circuits. These three methods are coming more into use and have caused a greater reduction in the danger and disturbance from lightning than the use of arresters. The connection of the neutral to ground will prevent in a large measure the oscillation of the system when there is a discharge.

E. E. F. Creighton replied to the criticism of the aluminum arrester by stating that it was designed specifically to take care of continuous surges for a considerable time, which the multigap arrester cannot do, because of the heavy current. For lightning the gap can be set high, but for an arcing ground it is necessary to have a small gap. A fuse can be used in the circuit and is better adapted to the aluminum arrester than to the multigap. He considered it better, however, to keep the arrester in good condition than to use a fuse. If you ground the neutral you transfer your trouble from potential troubles to current troubles. In a small system the latter are negligible, but in a large system there may be a heavy current surge resulting in high potentials.

E. J. Richards had used aluminum arresters on lines at main station and substations and had had very good results during two years of operation. A heavy lightning storm a few weeks ago had ruined one set of arresters and put the substation out of business, but did not injure any other apparatus. The line is constructed on steel towers with a ground wire above the transmission line. Two circuits are carried triangulated with six-foot spacings and the line is seventy miles long. Every tower is grounded to the ground wire. Only one interruption has been had due to insulator trouble. This was due to a direct stroke of lightning. Other insulators have been lost, but without interruption to service.

N. J. Neall spoke of the tremendous advance in the art and thought a great deal was to be gained by comparison of operating results.

H. L. Wills had obtained good results by connecting the lightning arrester between line and ground wire at one pole and between the other line and ground wire at the next pole.

A. S. Ives testified to the efficiency of the overhead ground wire. His line of fifty miles and 33,000 volts was built on specifications reported at the Atlantic City convention, and no trouble from lightning had been experienced.

The session then adjourned.

SECOND SESSION.

President Freeman called the second session to order on Friday morning. The first paper was by H. A. Wagner on "Increasing the Flexibility and Reducing the Cost of Operation of Steam-Boiler Plants by the Use of Fuel Oil."

USE OF FUEL OIL.

The author described the system employed by the Consolidated Gas, Electric Light & Power Company in its Westport station for using coal and oil simultaneously for fuel. The space under the boiler back of the usual coal grate is made into a large combustion chamber with the oil burners at the extreme rear end. This chamber is separated from the coal grate by a low wall. Each furnace is provided with four oil burners. Oil is delivered to the boilers under pressure of twenty pounds per square inch and is atomized in each boiler by means of a steam jet. Under operating conditions the boiler outputs obtained during seven-hour runs have been as follows: With coal used alone, 1,188 horsepower; with oil alone, 702 horsepower; with coal and oil together, 1,445 horsepower. It was found that a 2,000 kilowatt station load can be carried by each boiler when using coal and oil together with as much ease as 1,200-kilowatts when coal is used alone. The results indicate a gain in output of 66 per cent by the use of the oil or a saving of 40 per cent in the cost of the boiler equipment for a given output. The cost of oil for producing a certain amount of steam is about 33 per cent more than that of coal. In spite of this the cost of banking is less with oil than with coal, for the reason that the oil is burned efficiently while the coal is necessarily burned very inefficiently. A saving in investment and in labor for peak load can be effected by the use of oil. Fuel oil shows its advantages as compared with coal most markedly when used as fuel for operating steam plants as auxiliaries to hydroelectric stations.

M. C. Kennedy outlined conditions in Syracuse, where the local company receives up to 6,000 horsepower from the transmission company and operates a steam plant in parallel for the peak load. During off-peak hours the turbogenerators float on the line to provide against interruptions. Reverse relays prevent power from being supplied to the transmission line. Nine of the twenty-two boilers use oil for fuel, the remainder coal. The nine boilers are for emergency use and are kept hot by steam from the others. When transmission service fails, the oil-heated boilers are placed immediately in service.

W. L. Abbott said that the amount of coal consumed in banking is not generally appreciated. The use of oil should save a ton per day on a 500-horsepower boiler. Oil could also be used for peak loads, but is too expensive to compete with coal for everyday work.

George H. Walbridge then presented a paper on "Method of Determining the Cost of Steam Power Under Various Conditions."

COST OF STEAM POWER.

Curves were given showing the factors which control the cost of steam power in the various parts of the territory covered by the circuits of the Central Colorado Power Company, the pounds of coal per kilowatt-hour and the cost of coal in mills per kilowatt-hour for different types and sizes of engines were given. There was also shown the cost of boiler-room labor in dollars per kilowatt-year as affected by the pounds of coal required per kilowatt-hour. A separate set of curves showed the cost of banking in mills per kilowatt-hour as affected by the cost of coal in dollars per kilowatt-year; there was also shown the relation between the cost of engine-room labor and the rating of the station. These curves should prove useful for rapid and rough approximations in cases where an engineer is not well supplied with other data.

The remainder of the session was devoted to a topical discussion of operation of transmission systems.

D. B. Rushmore pointed out that local Edison companies could make use of power from high-tension transmission lines as soon as reliability is assured, a condition rapidly approaching. Better service seems to be given on high-voltage systems, such as the 100,000-volt line between Great Falls and Butte, Mont. This has been interrupted only once in four months. He read written discussions which had been submitted by Max Hebgen, the designer and operating engineer of this line, and by J. P. Jollyman and R. S. Kelsch.

UNINTERRUPTED SERVICE ON TRANSMISSION SYSTEMS.

M. Hebgen, of Butte, Mont., in his communication calls attention to the fact that failures of insulators cause more line shutdowns than any other cause. This is because they have a much lower factor of safety than other elements of the system. For 100,000-volt lines the factor of safety should be three, for 50,000 volts it should be four and for 20,000 or 30,000 volts it should be five; this is because abnormal surges are relatively greater in lower than in the higher-voltage lines. For voltages of 20,000 and over, Mr. Hebgen is in favor of suspension-type insulators. Insufficient attention is frequently given to the mechanical strength of the line, particularly where it crosses rough country. Transmission lines should be in duplicate or triplicate, preferably on separate pole or tower lines. For convenience in handling, trouble lines should be sectionalized by outdoor air-break switches. Incoming lines should be protected by reverse-current relays. Grounds cause more frequent trouble than short-circuits between lines. Much attention should be given to the proper patroling of the line. Speed should be less a feature than thoroughness in this work, as incipient causes for future trouble must be discovered, if possible, by close inspection.

R. S. Kelsch, of Montreal, Canada, stated that there are two methods of operating transmission lines; one is to give it constant care and attention, daily patroling, discontinuing the power frequently to straighten up a pole, change an insulator, remove a limb of a tree, etc.; the other and more successful method is to give the design and construction of the line the same factor of safety that is employed in designing the power house, where reserve generators, busbars, exciters, transformers, switches, etc., are provided to assure continuity of service. If the latter practice were applied to the line, practically no patroling would be needed. Too much economy is practiced in the purchase of insulators. Several lines have had their troubles practically eliminated by substituting insulators of a higher factor of safety.

J. P. Jollyman, of San Francisco, Cal., expressed his conviction that the power house should be so arranged on the unit system that it can be handled by the fewest possible number of men in case of any trouble. All apparatus in need of immediate attention should be in reach of one man. All apparatus should be of simple construction and readily accessible for repairs, for which spare parts must be on hand. The switchboard should be carefully and systemically laid out. Switches for different lines should be separated by fireproof barriers and relays sparingly used. Too much attention cannot be given to the design of the lines. There shoud be a large spacing between conductors; it is better to place these over each other than two on one cross-arm or bracket. Unusual strains from broken wires should be provided for. Regular weekly patroling is necessary; to make this more effective a telephone line should run below the entire transmbission line; 150-mile telephone lines have been run successfully under 100,000-volt circuits. Substations should have bypasses so they may be completely cut off the line without tying up the latter in case of substation accidents. Loop lines are best for distribution as well as transmission circuits.

W. N. Ryerson thought there was danger of getting too good insulation with suspension insulators. There must be some means for discharging abnormal voltages on the line, and if they do not spill over the insulators, they are likely to enter the station and injure apparatus.

F. B. H. Paine advocated the use of headlights by line patrolmen. Obscure troubles frequently arise and an instrument such as an oscillograph which will give a permanent and continuous record is urgently needed. He is changing his line to suspension-type insulators.

B. F. Pearson told of troubles with insulators in southern California, where the temperature sometimes exceeds 130 degrees. After about two years the petticoated insulators show evidence of internal fracture, apparently due to local action in the cement. The suspension-type insulator is the only one which has given satisfaction. There is no limit to the operating voltage possible, and lengths up to 250 miles are practical. Birds cause many short-circuits. Last year there were 160 interruptions from this cause on a line 118 miles long

P. T. Davies had overcome the trouble from birds by installing screeching windmills on the line.

J. R. McKee then took the chair, and invited discussion on a number of important points.

G. H. Walbridge told of troubles from wind in Colorado where the line reaches an altitude of 13,000 feet. A tensile strength of 50,000 pounds is the highest that should be used.

E. L. West told of conditions on a 180-mile line operating at 100,000 volts. Abnormal voltages with unloaded line give the most trouble. They evidently reach 300,000 to 500,000 volts sometimes. A factor of safety of 2.5 for insulators or transformers is not enough. The clamp that attaches the wire to the insulators should be as flexible as possible, as many breaks are due to nicked wire. He uses a new form of clamp, called a saddle. The ideal attachment is a smooth, easy saddle, hung so that it can swivel in all directions and held lengthwise by a clamp on each side. As much of the high-tension apparatus as possible should be out-of-doors. This also reduces the cost of buildings.

R. C. McClelland told of the construction of a substation for 75,000 (ultimately 115,000) kilowatts at 100,000 volts where nothing is covered except some of the oil switches.

R. G. Black told of using copper wire with a hemp center, which had never given any trouble. With a 60,000-volt line, using pin insulators, the only interruptions had been due to lightning. As the margin of safety is low, the circuit-breakers are set with only slight margin, and go out on a lightning discharge. With a 60-cycle line, without synchronous apparatus, the circuit-breakers could be set tighter.

P. H. Thomas advocated composing large networks of several sections, each having its own generator and load, connected at some central point through circuit-breakers. If there is a short-circuit on one section, it is cut out from the others automatically without serious trouble to them. The load could be immediately transferred from the injured section to an operating section. An impedance could be inserted in the connections to the common point to limit the short-circuit current. B. F. Pearson had used a similar scheme in California. Synchronous apparatus in one section is not disturbed when another section goes out.

N. J. Neall told of a manufacturing plant supplied by three hydroelectric and one steam station. Trouble was only eliminated by removing all circuit-breakers from the lines.

D. B. Rushmore concluded the discussion by summarizing the conditions. The tendency in construction is toward higher fixed charges and greater permanency with a consequent lowering of maintenance and repair charges, and better service. The transmission system of the future, according to Mr. Rushmore, must operate without any interruptions.

Commercial Section.

The first commercial session was called to order by Vice-president John F. Gilchrist, Wednesday at 10 a. m., and Chairman George Williams, of the Commercial Section, called upon for his address. This was followed by the report of the Committee on Power, of which E. W. Lloyd, of the Commonwealth Edison Company, Chicago, was chairman. An abstract of Mr. Lloyd's very valuable and comprehensive report is given herewith.

COMMITTEE ON POWER.

This committee reports on the results obtained from a canvass of about 900 central stations throughout the country, two blanks being sent to each company to fill out. From the replies received it would seem that almost every class of industry is being served in some community by a cen-

tral-station company. These industries include woodworking establishments and other establishments where fuel is cheap or where the steam requirements are so large that central-station service would seem prohibitive in cost. The report calls attention to the work being done in commercial departments of central stations and refers to the class of men available for power soliciting. The data received from the companies written to is compiled in tabular form. Table No. I gives a list of the various classes of industries served in the several towns, with the name of the company supplying the current, horsepower installed in motors, group or individual drive, running hours of factory per week, kilowatt-hours consumed per annum and kilowatt demand. Table No. II gives a very complete list of horsepowers required to drive various machines, this list being supplementary to the list already published in the Solicitor's Handbook. The next table gives very interesting data relative to monthly kilowatt-hours used by small refrigerating machines in operation in Philadelphia, Pa., and connected to the lines of the Philadelphia Electric Company. The fourth table gives information as to the power required for the making of artificial ice. This table shows that the average current consumption per ton of ice delivered on the loading platform is forty-three kilowatt-hours. The data is taken from a 100-ton ice plant. Other information taken from this same installation indicates that the annual load-factor of the business in the latitude of Buffalo, N. Y., is about sixty-five per cent. Other data seem to point toward the fact that the maximum demand per ton capacity of machinery installed, where the machinery is seventy-five-tons capacity or greater, is about 2.3 kilowatt-hours per ton. This includes the power for operating compressors and all auxiliary apparatus.

This report was discussed by Messrs. Graves, Dell Plain, Gille and Lloyd. Mr. Graves commented on the value of the data contained in the report, but suggested that in the future when companies are requested for similar figures they give results on a number of installations of similar character.

M. O. Dell Plain, speaking of the compilation of data relative to horsepower requirement, said that it is hard to tabulate the horsepower requirements of different machines, due to the fact that conditions vary so much in almost every individual case. In Syracuse, a graphic wattmeter test is made for every motor installation. In addition to this record, a card is filled out and filed, containing specific information on the conditions under which the particular motor is operated. Mr. Dell Plain also called attention to the lack of general and specific data relative to electric-steam-heating plants.

H. J. Gille, of Minneapolis, spoke of the vast amount of work that Mr. Lloyd's report represents. He said it paved the way to obtaining information regarding the approximate number of kilowatt-hours per unit of the product in the various industries.

R. L. Lloyd, of Philadelphia, called attention to the marked difference in kilowatt-hours' consumption of four ice machines of the same size given in the table. This difference was due to two machines being of the automatic type and two non-automatic. Mr. Lloyd said that this emphasizes the necessity of obtaining full data on any power-installation test brought out.

E. W. Lloyd, of Chicago, in closing the discussion, emphasized the necessity of compiling more data on this subject.

The report of the Committee on Electricity in Rural Districts was then presented by J. G. Learned, of Chicago, chairman.

ELECTRICITY IN RURAL DISTRICTS.

John G. Learned, of the North Shore Electric Company, Chicago, chairman of the Committee on Electricty in Rural Districts, submitted a report which deals with the subject in its commercial form alone, not going into any of the technical features —the object being to present a view of the situation from the standpoint of the central station and interurban electric railway, and to stimulate interest in the subject among the members of the Association. The report is accompanied by seventy-eight illustrations giving views of the application of electricity on farms and for power purposes in rural districts. The report includes a tabulation of the returns received from a circular sent out by the committee asking for data relative to central-station business in rural districts. It is stated that the basis of development of rural electrical supply rests upon the extension of the lines of central stations in country towns, on connecting with interurban transmission systems, and with the transmission disturbing lines of interurban railways. In many cases it has been found advisable for a company to bear the expense of bringing the service to the rural customer, although this is not the general practice at present. The rural electric motor load is usually off the peak, and this is very often true with respect to the lighting load. It is believed that a great many rural customers can be secured consuming enough energy to pay the central station for the effort to reach them. If, however, an increased rate is charged for rural service the farmer will not favor its adoption and will turn to other means now continually offered, such as gasoline engines, gasoline-engine-driven dynamos, etc. Business should be encouraged also by means of installment payments, cost price on wiring and similar inducements.

This report was discussed by Messrs. Gille, Kennedy, Parker, Callahan, Scherck and Edwards. H. J. Gille, of Minneapolis, asked if any information had been gathered in regard to the cost of extending lines in the rural districts. Mr. Learned said that local conditions would have to govern the cost in each case.

S. M. Kennedy, of Los Angeles, described the development of rural business in Southern California. The central station there (Southern California Edison Company), extends its lines over a very large territory and supplies service to over thirty cities and intervening territory. In extending lines, the hightest standard of construction is used. The average cost of such construction, depending on the voltage of the lines and the nature of the ground over which the extension is made, ranges from $600 to $1,200 per mile. The custom of the Company in regard to the relation of the value of the business to the cost of the line is based usually upon the immediate income, first, and second, the prospective income. As a rule, the Company considers that it will make extensions to any distance upon the basis of 50 per cent of the first year's income; 50 per cent of the cost of the line being represented by the first year's income, the presumption being that in future years, the percentage will be considerably increased by the addition of other business. Mr. Kennedy said the amount of the business which can be added, of course, depends upon the character of the country through which it is built. An extension to one district of twenty-six miles was made recently and the contract which was signed required in this instance that the consumer should pay for one-third of the cost of the line, the company supplying the additional expense. In cases of rural distribution, the consumer in many instances owns and pays for the transformers necessary in stepping down from the high voltage to the voltage required for the motors. In some instances where the rates are higher and the business smaller, the company supplies the transformer.

Mr. Parker spoke of the reclamation of marsh lands and the irrigation of dry land. Both of these operations can be carried on with electric power and the result is much more valuable land, increased population in the territories so affected with a corresponding greater field for marketing current. Mr. Parker said that under these conditions of increased demand, by reason of the increase in the density of the population the cost of the pole-line extensions is not prohibitive.

E. L. Callahan, of Chicago, asked if in many cases the customer would not require an installation of transformers and line equipment that would exceed in cost the revenue obtained. Mr. Parker said that under the conditions he mentioned, the tendency would be towards small farms. This would bring the residents of a district closer together with resultant social activity

on the part of the farmers, thus increasing the lighting load.

H. M. Edwards, of New York, spoke of the difficulty of obtaining data on this subject. He asked for the co-operation of operating companies and called particular attention to the bulletin devoted to the producing of farm products published by the Department of Agriculture.

The report of the Committee on Ornamental Street Lighting was next presented by William R. Collier, of Atlanta, chairman.

ORNAMENTAL STREET LIGHTING.

The report of the Committee on Ornamental Street Lightning is confined to those systems where their beauty by day and by night and the spectacular effects obtained are of great importance as well as the actual efficiency; in other words, where a part of the light is chargeable to illumination and a part to advertising. Three systems are used, arc lamps, festoons or arches, and the ornamental tungsten posts. The advantages of the arc system are: ease in making spectacular effect, high efficiency and relatively low maintenance cost. The first cost is quite high, however, if the lamps are placed close together. The festoon system is losing its popularity because it has several serious drawbacks, among which are rusting, and therefore weakening of the steel arches or span wires, temporary appearance and not attractive by day and liability for serious lamp breakage from storms. For these reasons many of the festoon installations are being abandoned for the tungsten-post system, which, since its successful installation at Minneapolis a few years ago, has been rapidly extended in practically all parts of the country. Five-light clusters are the most popular. In nearly all cases the lamps are fed from underground circuits. The patrol system is generally used for lighting and extinguishing lamps. The installation in Atlanta is described as being typical. It has 239 posts, each equipped with five 120-watt lamps run five in series across a 230-volt direct-current underground circuit. Tables of data are given regarding fifteen arc installations, nineteen of the festoon or arch type, and eighty-two of the tungsten-post type. The following questions of general policy respecting such ornamental lighting are discussed: Who should pay for the installation? Who should pay for the maintenance? What should be the form of agreement? What is the best method of obtaining signatures? In general, the parties who are most anxious to get the light pay for it. The payment should be on a uniform front-foot basis. Outside solicitors should not be employed. The report includes an article on "The Benefits of Better Street Lighting" and a number of typical contract forms between central stations and cities or merchants' associations. Throughout the report are some twenty-five illustrations of various installations.

V. R. Lansingh, of New York, opened the discussion. He referred particularly to the difference in placing the lamps upright and pendant, citing tests that have been carried on to determine the different results. Under exactly identical conditions the results of these tests showed that there was an increase in useful light on the street at a distance of ninety-five feet of 25 per cent in useful flux with the pendant installation. He compared the reflectors available for street lighting and gave results on efficiency tests carried on with each type.

T. I. Jones, of Brooklyn, said the main point to consider in ornamental street lighting is the beauty and advertising value of such an installation. He said where there is regular city lighting and the merchants pay for the ornamental installation the appearance is of prime importance.

C. N. Duffy, of Milwaukee, spoke of the value of ornamental street lighting as an advertisement—both to the merchants and to the city. He described the campaign carried on in Milwaukee and advocated uniformity in street lighting. In regard to the collection of bills, he said that in Racine, the revenue becomes a tax against the property and is spread in the tax books. It is collected the same as any other tax and no trouble is encountered.

S. M. Kennedy, of Los Angeles, said that ornamental street lighting in Los Angeles has constantly increased without any efforts on the part of the central station. A phase of the question which has arisen, however, in connection with the extensive street lighting in Los Angeles, is the decrease in sign and window lighting. In regard to the former, a city ordiance prohibits signs from projecting over eighteen inches from the building line. The local municipal league refuses to consider an amendment to this ordinance on the plea that it would mar the effect of the street lighting. Mr. Kennedy said that this is a case where the ornamental street lighting prevented the company from deriving greater revenue from the sign and window-lighting business.

Arthur S. Ives, of Poughkeepsie, N. Y., spoke of the benefits to the taxpayer from an ornamental street-lighting installation. He said that it is not only the merchants who are benefited from such installation, but the entire city and an increased interest in electricity for lighting results.

SECOND SESSION.

The second commercial session was called to order Thursday morning, with F. M. Tait in the chair. Announcement was made that C. A. Coffin would address the convention just before the afternoon sessions. The report of the Committee on Electric Vehicles was then taken up. In the absence of J. T. Hutchings, chairman, the report was presented by H. W. Peck.

ELECTRIC VEHICLES.

This report calls attention to the possibilities of the electric vehicle as a labor-saving device, its application in the work of electric lighting companies being subdivided into the following classes: (1) general hauling of all kind; (2) the hauling of heavy material, such as transformers, reels of cable, etc., in which the electric winch is indispensable; (3) the application of the electric vehicle in the construction of aerial lines, where electrically operated cranes are used for erecting and moving poles, etc.; (4) the use of the electric vehicle in underground work for the drawing in and out of cable and pumping out of manholes; (5) the use of the electric tower wagon for trimming of arc lamps, etc., (6) the adaptability of the electric vehicle as an advertising medium. The Committee urges the use of electric trucks by every central station and also the compilation of accurate data on the cost of operation. The total cost of operating electrics should be classified under three general heads: (1) General expense—such as supervision, garage rent, wheel tax and state license; (2) operating expense—including the cost of oil and other supplies, general repairs, cost of electric energy, cost of repairs on batteries and tires, drivers' salaries, washing, oiling, and minor repairs and garage expense; (3) fixed charges—interest, taxes, insurance and depreciation. The report includes a statement from C. E. Michel, of the Union Electric Light & Power Company of St. Louis, regarding the advantages and disadvantages of selling vehicles and maintaining garages by central stations. It is the opinion of the committee that where there is no active competition in the sale of electric vehicles it would be well for the central station to handle the matter as has been done with motors, heating appliances, etc. The report touches briefly the matter of tire trouble, electric-vehicle accounting and insurance rates for electric-vehicle garages.

P. D. Wagoner, of Long Island City, opened the discussion, calling attention to the importance of accurate data on cost of operation. He also called attention to the difference in current consumption between vehicles equipped with different tires. He urged that central stations be particular in recommending proper tires for their customers.

D. Baker, of Boston, spoke of the efforts being made by the Electrical Vehicle Association of America to reduce the insurance on electric vehicles. He asked for the co-operation of central-station men in this respect.

W. H. Blood, Jr., of Boston, spoke of the advantages of the battery-charging load to central stations. He also called attention to the harmful policy adopted by some companies of advocating the electric for all kinds of service.

R. L. Lloyd, of Philadelphia, spoke of the tremendous increase in the sale of commercial electric vehicles as reported by the manufacturers, showing that the commercial car is being adopted as readily as the pleasure car.

P. D. Wagoner, adding to Mr. Lloyd's

statement, said that the business of the company with which he is connected, during February, 1911, sold more cars than during the entire year of 1908 and about the same number as during the year 1909.

Frank W. Frueauff, of Denver, urged the central-station men to take a greater interest in the electric-vehicle situation.

H. S. Knowlton, of Boston, described the activities of the Boston Edison Company in electric-vehicle matters. He referred to the weekly luncheons held and to the co-operation of all electric-vehicle dealers with the Edison Company.

C. F. Smith, of Boston, speaking of keeping records of the performance of the batteries, asked how a record may be kept when the battery is also used to supply current to electric pumps, winches, etc., with which some central-station vehicles are equipped. J. W. Brennan, of Detroit, said that equipping the battery with a Sangamo meter would be a means of keeping a record of the work done when the car was at rest. Mr. Brennan also spoke of the vehicle campaign carried on in Detroit and of the excellent results obtained in view of the strong gasoline competition.

George H. Whitfield, of Richmond, Va., spoke of the increase in electric vehicle sales after it was announced that the central-station company would provide a garage for their storage and care.

M. S. Seelman, of Brooklyn, called attention to the road run conducted by a leading newspaper in New York some time ago in which the electric vehicle received considerable publicity. He also spoke of the increase in the electric-vehicle business in Brooklyn.

E. Douglas, of Milwaukee, discussed the electric-vehicle question from the standpoint of good roads. He said that the condition of the streets would probably have a bearing on the application of electrics. Day Baker, of Boston, cited his experience with an electric vehicle having had six years' service over unpaved roads. It appeared almost a duplicate of a new machine.

R. W. Rollins, of Hartford, stated that the cost of energy for runabouts in his company's service figured about one cent per kilowatt-hour. On the same basis 1,000-pound vehicles cost $1.00 per week.

S. M. Kennedy, of Los Angeles, emphasized the importance of central stations using only electric vehicles in their service. He said it is very difficult to ask a man to buy an electric if the company is using a gasoline machine.

E. F. McCable, of Titusville, Pa., inquired about the use of flat rates in selling energy for electric-pleasure-vehicle service. J. R. Brennan, of Detroit, said that the practice in Detroit is to make a low energy rate of about four cents per kilowatt-hour, installing a separate meter for commercial-vehicle service.

E. L. Callahan, of Chicago, stated that in Oklahoma City the central-station company has five electric wagons and one runabout in its service. The runabout has paid for itself in connection with the new-business department's work. The revenue of the company from battery-charging is about $1,000 per month. There are about 350 electrics in the city.

H. L. Parker, of Baltimore, said the Baltimore Company has a flat-rate proposition of $25 per month for maintaining and charging 1,000-pound trucks. He described a demonstration made for a milk dealer who contended that an electric could not go over the rough streets.

T. I. Jones, of Brooklyn, contended that the price charged for energy is a point vital to the sale of electric vehicles. He said that if the electric vehicle is going to be pushed at all it must be along economical lines.

E. W. Lloyd, of Chicago, described the activities of the Commonwealth Edison Company in pushing the sale of electric vehicles. The company's charge for vehicles in public service is four cents per kilowatt-hour maximum.

Arthur Williams, of New York, said that there is a tendency to place too much emphasis on the rate for electric energy in advocating the use of electric vehicles. Assuming in any event the rate payable for energy seems high, it stands to reason that anyone requiring service of that character cannot afford to use electric current if he is going to place emphasis on its price. He said the electric-vehicle men are far too modest in their claims for the electric vehicle. The controlling considerations are cheapness, simplicity, economy and longevity. Mr. Williams held that all that has to be done is to show the superiority of the service, the simplicity of the management and the low cost of delivery of the electric.

Mr. Peck closed the discussion by thanking Mr. Smith for calling attention to the importance of keeping records of the auxiliary apparatus on a vehicle and Mr. Brennan for suggesting the method of keeping such records. Regarding rates, Mr. Peck said that he did not think the flat-rate system could be satisfactorily applied to battery charging unless it is combined with garage maintenance at a figure which would be profitable to the central station through a period of years.

George R. Stetson, of New Bedford, Mass., reviewed his experiences in purchasing electric vehicles for service of his company. He started with a 1,000-pound truck used in taking care of meter service. The first expense incurred in two years has been a set of wheels at a cost of $158. This truck has run over 2,000 miles and has accomplished the work of two horses and four men during the two years. The company now has four trucks in service.

Before adjournment, the chairman called upon Philip S. Dodd, of Cleveland, to explain the co-operative electrical-advertising scheme carried on in the Cleveland newspapers.

Following the remarks of Mr. Dodd an executive session was held.

THIRD SESSION.

The third commercial session was called to order Thursday at 2:30 p. m., with President Freeman in the chair. The first business taken up was the report of the Committee on Residence Business. Clare N. Stannard, chairman, presented the report.

RESIDENCE BUSINESS.

The report of the Committee on Residence Business considers the subject under the heads of desirability of residence business, means of getting such business and the results that had been obtained in securing residence lighting. As to the first question the reply is that there is no doubt that residence business is desirable, the point to be decided being how desirable. As the result of an inquiry among member companies the consensus of opinion is practically unanimous that apartment business is very desirable. As to the other classes, whether it is desirable depends upon the saturation of the lines in the residence districts and whether the construction is overhead or underground. Nevertheless, the educational or advertising value is in many cases sufficient to warrant taking on residence business regardless of whether it is profitable or not. For suburban territory, the advantages between street overhead, sidewalk and backyard construction of distribution lines is in favor of the latter as being on the whole least expensive. It is stated the greatest difference of opinion exists as to the advisability of companies rendering any financial assistance to a prospective customer in installing or equipping his installation. The practice varies from free wiring, with a nominal charge for fixtures, to no assistance whatever. Competitive companies usually render some assistance to the customer. As to the advisability of companies going into the fixture and wiring business, the great weight of opinion is toward the protection of the contractor by employing him as the agent of the company to do the work, the

company paying the contractor and collecting from the customer.

A valuable feature of the report consists of a number of plans for wiring relating to two model houses, one of the bungalow type, costing $3,000 complete, and the other of two stories and basement, costing $8,000 complete. All circuits and outlets are indicated on the plans, and schedules given of the material required and of all appliances that it will be desirable to have the customer install. In conclusion, the committee states that the results reported in securing residence business have been most encouraging, showing increases of from 20 per cent to 40 per cent in residence business over the previous year. As to the revenue secured there is a great difference, the amount varying from $18 to $40 per year, a fair average being $25 per customer. The figure for kilowatts connected varies from $18 to $22, the average being $21 per annum.

In the discussion Douglas Burnett, of Baltimore, questioned the advisability of charging the customer for the service wires from the building to the pole lines, where competitive gas or gas and electric companies exist. He said that where a combination gas and electric company exists no charge should be made.

A. S. Ives, of Poughkeepsie, called attention to the fact that in making extensions, plant investment as well as line investment should be considered and that the revenue should be about ten per cent above the actual cost of the energy, divided between interest and investment charges.

H. J. Gille, of Minneapolis, spoke of the desirability of residence business and the returns therefrom. From an analysis made of 4,000 residences at Minneapolis, flats consumed on an average of 27.3 kilowatt-hours per month during the year and residences 26.5 kilowatt-hours.

R. M. Searle, of Rochester, recited his experiences in residence business. He said that his company was somewhat backward in canvassing this business, but realized the opportunities in this field.

P. H. Kemble, of Toronto, called attention to the serious defects in the present method employed by the association in obtaining information.

The report of the Committee on Electric Heating, Refrigeration and Kindred Appliance Sales was then presented by Frank H. Gale, chairman.

ELECTRIC HEATING, REFRIGERATION, ETC.

In this report, the subjects taken up were considered under the heads of domestic and commercial heating appliances, domestic and commercial cooking appliances, domestic lighting appliances, comprising novelty lamps, portable, fancy lamps, etc., and domestic and small power appliances, comprising domestic refrigeration, ventilation, vacuum cleaning and miscellaneous small-motor applications. It is stated that the flatiron is the greatest electric heating revenue producer singly, the average income being about sixty-five cents per month. It is estimated that last year 250,000 flatirons were sold in the United States and Canada, or one to every four residence electrical customers. The heating pad is second in popularity, and air heaters and luminous radiators are steadily growing in favor. The report considers in detail the situation in various industries with respect to electric heat and power, in many cases giving interesting data. The use of domestic cooking appliances was found to be increasing. Answers were given to sixteen questions sent out to central-station companies relating to electric cooking. Two stations report their cooking rates to be 5.5 cents per kilowatt-hour; nineteen, five cents; one, 4.5 cents; one, four cents; five, three cents, and two, 2.4 cents. All stations answering questions as to the minimum charge said that this was $1 per customer. The possibilities of commercial electric cooking are reported to be encouraging. In a report on home refrigeration it is stated that one manufacturing company has sold in the vicinity of New York City and New Jersey 170 one-quarter-ton outfits, which are economical for any household which uses forty pounds or more of ice per day. The use of ozone generators is said to be extending, and this apparatus promises a use of electric current that will grow in this country as it has done in Germany and other European countries. The electric vacuum cleaner is becoming very popular and where placed in service invariably gives satisfaction.

Following the reading of this report motion pictures were exhibited showing the application of electricity to the servant problem. There was no discussion.

The report of the Committee on Improved Wiring and Equipment Standards was then presented by M. C. Rypinski, chairman.

IMPROVED WIRING AND EQUIPMENT STANDARDS.

The Committee on Improved Wiring and Equipment Standards attempted to gather data respecting the attitude of the central stations to the wiring of consumers' premises. A set of eight questions was sent out to the 1,000 member companies and 160 replies received. A summary of the latter constituted the main part of the report. In about half of the replies it was admitted that no system of aiding the consumer financially in wiring his home was in use. The other companies all have some more or less elaborate method of taking care of the consumer. The most common practice is to do the wiring or have the wiring done for the consumer at cost, or cost plus a small profit, allowing the consumer to pay for the wiring by monthly installments, varying anywhere from two up to twenty-four months. The second question, whether any technical program was being advocated for the proper layout for wiring of houses with special reference to placing of outlets, etc., brought out that less than one-fourth the companies have given the matter consideration. A few have a definite program of this character; others leave it to the solicitors to suggest outlets for appliance and convenience service; some have a bureau of illuminating engineering to advise as to location of outlets, sizes of units, etc.; and in some companies the consumers are asked to avail themselves of the services of a branch of the regular engineering department for this purpose. Respecting the enumeration of various electrical conveniences, the same companies call the attention of prospects, old customers, architects and in some cases of contractors to the numerous electric cooking and heating appliances, vacuum cleaners, laundry devices, fans and other motors, etc., that are now available, and for which convenient outlets should be provided. As to co-operation with contractors, the replies varied a great deal, some advocating this strongly and others finding it undesirable as the result of past experience. Relatively little satisfactory educational work has been done with architects. As to whether the cost of wiring had a retarding effect, a large number of replies indicated that it did retard about fifty per cent of possible central-station patrons. These also suggested that a reduction of twenty-five to fifty per cent in wiring costs would have a salutory effect. In a few cases it was thought that the National Electrical Code set too high a standard, in others that the new English concentric-tube system might be employed in order to reduce the cost, and again it was felt by many that the tendency is toward increased instead of reduced costs. The committee is co-operating with other organizations in the compilation of a handbook on wiring, which will encourage the greater use of electricity and create a desire for improved and more adequate wiring in residences.

There being no discussion of this report, M. S. Sloan, chairman of the Committee on Industrial Lighting, presented his report.

ILLUMINATION FOR INDUSTRIAL PLANTS.

The report of the Committee on Industrial Lighting consists of a number of monographs, including descriptions of actual lighting installations or plans for the same. The first paper is by W. D'A. Ryan, of the General Electric Company, which, under the title of "Industrial Lighting," lays down the fundamental principles applying.

C. E. Clewell, of the Westinghouse Electric & Manufacturing Company, contributes to the report a paper prepared by the illuminating engineering department of the Westinghouse Company, describing with many illustrations, the manner of installing over 7,000 tungsten-filament lamps for lighting about ten acres of floor space in the Westinghouse plant at East Pittsburg. H. J. Tait, of the Holophane Company, contributed a paper on reflector maintenance, giving practical instructions. J. S. Codman contributed a communication from the National Electric Lamp Association entitled "Industrial-Plant Lighting," which lays down the fundamental principles concerned and includes a number of illustrations of lighting in factories and shops.

S. W. Ashe, of Harrison, N. J., opened the discussion, calling attention to the fact that in the future a much more careful study will be necessary regarding the different types of illuminants. He asked a number of questions regarding points brought out in the installations described.

Normal Macbeth, of Bloomfield, N. J., spoke at some length on the commercial value of good illumination and suggested that central-station managers view the problem of industrial lighting in the light of the larger returns which such business affords. Referring to actual installations, Mr. Macbeth said that in factories having low ceilings the maximum unit was a 100-watt lamp, while a sixty-watt lamp probably would give the best service.

M. O. Dell Plain, of Syracuse, stated that the results of tests on lights served from the company's twenty-five-cycle system showed a very noticeable flicker if reflectors having radial corrugations were used.

T. I. Jones, of Brooklyn, reported that they have had no trouble whatever with flicker.

W. D'A. Ryan, of Schenectady, called attention to a portion of the report where illustrations show two reflectors of the same type giving different results. The better result is obtained from a reflector a little more expensive than the other and Mr. Ryan said this emphasizes that careful study is necessary in obtaining the best results.

H. L. Parker, of Baltimore, spoke of the necessity of having specially trained men for industrial soliciting. Mr. Sloan closed the discussion, replying in part to some of the questions asked. The meeting then adjourned.

FOURTH SESSION.

The fourth commercial session was called to order by John F. Gilchrist on Friday morning and the report of the Committee on Electric Signs presented by E. L. Callahan, chairman.

ELECTRIC SIGNS.

The report of the Committee on Electrical Advertising describes the bulletin on electrical advertising which has been compiled by the committee for the purpose of aiding central stations in securing sign business. This bulletin contains reproductions of recognized successful displays now being operated in various parts of the country. The engineering data contained in it will be of valuable assistance in preparing specifications for electrical displays of merit. The report calls attention to the harmful influence of poorly designed and installed signs, and in this connection presents a model sign ordinance as a suggestion for central stations. The ordinance provides for the annual inspection of electrical displays, supervision of the size, location, hanging and general appearance of all signs, etc. The committee urges that every central-station company should refuse to connect its service to an electric sign or similar electrical advertising display should any part of the installation not meet with the requirements of the National Board of Fire Underwriters, or comply with the rules and requirements of the local fire department and department of electricity. In conclusion, the report offers five suggestions for future work along the lines of display advertising and suggests that the Association give the future committees financial aid to carry out the plans for national electrical advertising proposed at the St. Louis convention.

E. A. Mills, of New York, opened the discussion emphasizing the importance of electric-sign legislation. He reported that an ordinance limiting the height of signs had been taken to the courts and declared unconstitutional. He also referred to the methods of the New York company in pleasing sign prospects in the matter of design. The company employs a designer who prepares sketches according to the customer's ideas and when approved they are given to the manufacturers who send their estimates directly to the customer.

Frank Hammond, of Birmingham, spoke of the success of the sign business in Birmingham. He said there was a very liberal sign ordinance in effect there. Speaking of lamps burning out, Mr. Hammond said that some trouble has been encountered with five-watt tungsten lamps in alternating-current service but no trouble in direct-current service.

T. K. Jackson, of Mobile, spoke in favor of placing the control of sign installations under the supervision of some municipal authority. He said that liberal ordinances are likely to lead to abuses.

John F. Gilchrist, of Chicago, pointed out the need of exercising a large amount of diplomacy in connection with the sign problem. He said the only excuse which warrants permitting the use of the space above the sidewalk for electric signs is that the obstacle shall serve some function which shall more than compensate for the obstruction. There is no question that the illumination given by the sign is an advantage to the city. He thought that it would be of benefit to all concerned to pay the city a rental fee which would cover the cost of inspection and thus safeguard against accidents.

H. L. Parker, of Baltimore, spoke of the harmful influence a sign accident in Philadelphia had on the business in Baltimore, although the sign was not of the electric type. This emphasizes the need of inspection of all signs by central stations.

C. A. Littlefield, of New York, also spoke in favor of strict regulation of electric signs. Speaking of rates, Mr. Littlefield advocated the flat rate as it encourages long-hour service.

W. A. Donkin, of Pittsburgh, spoke of the status of the sign business in his territory. He also urged the importance of careful installation and inspection.

In closing the discussion, Mr. Callahan favored the flat-rate system of charging and rigid inspection.

The report of the Committee on Competitive Illuminants was then presented by H. J. Gille, chairman.

COMPETITIVE ILLUMINANTS.

Comprehensive data on gas and gasoline lighting is presented in this report, in such a shape as to be easily comparable with similar data on electric lighting. Considering gas lighting first, it is stated that eighty-five per cent of the gas outlets installed in this country are equipped with open-flame burners. A table presented, showing the principal types of gas lamps and the makers' ratings as to gas consumption, gives the relative useful illumination produced per cubic foot of gas as twenty per cent, for the open-flame burners. Therefore, the only type of gas lamps that can be considered competitive of the present-day high-efficiency electric lamps are those in which the light is emitted from incandescent mantles. The various types of high-efficiency gas lamps are described and comparisons made with similar electric lamps. In this comparison such disadvantages of gas lamps as fire risk, excessive heat given off, constant attention required, rapid deterioration, vitiated air when burning, and comparatively limited possibility of securing artistic effects are mentioned. In addition, the report states that the performance of a gas lamp depends upon the following variables: (1) construction of the burner; (2) quality of the mantle; (3) adjustment of the burner; (4) quality of the gas; (5) gas pressure and (6) atmospheric conditions. A consideration of all of these variables which affect the candlepower of gas lamps shows that not more than 60 to 70 per cent of the initial laboratory rating can be obtained under good service conditions. This statement is borne out by results of tests carried on by gas engineers. It is stated that, in general, it will be found that a tungsten lamp having two-thirds the mean spherical candlepower shown by an incandescent gas lamp in a photometeric test, will, under service conditions, produce an equivalent or greater illumination than the gas lamp, provided that the distribution of light from the two units are equally favorable. If a certain wattage in tungsten lamps is equal to an incandescent burner in a laboratory illuminometer test, then approximately three-fourths of this wattage will be found equivalent to the gas burner under service conditions. Comparisons of Reflex and tungsten lamps, based upon tests of bare units, of units equipped with reflectors, and tests of illumination produced check closely and show that a capacity of fifty-five watts in tungsten lamps is the equivalent of one Reflex burner. A table giving a comparison of annual operating costs of gas and Mazda units is included in the report. This table shows that, at the usual rates for electricity and gas, the total cost of operation with Mazda lamps is in reality less than for inverted gas lamps and is not more than two-thirds the cost with upright units. The report concludes with a description of the various classes of gasoline appliances used and the insurance laws in regard to their use.

S. W. Ashe, of Harrison, said that the average candlepower of a lamp during its life should be used as a basis of all engineering service comparisons. Mr. Ashe regretted that data was not given on mercury-vapor lamps. Recent tests on a lamp of this type showed that a direct-current equipment maintained sixty-one per cent of its initial candlepower during its life, an average candlepower of seventy-five per cent being obtained in an alternating-current lamp of the same type. He also gave figures showing the gas consumption of illuminants under service conditions.

Norman Macbeth criticised the report in that it was unfair to the gas interests

and said that electricity could not compete with gasoline on the ground of first cost and that solicitors would be liable to misrepresent the first cost of an electrical installation, assuming the statement to be true. He also said that inverted burners can be successfully operated on pressures as high as two inches, although one inch is given as the limit in the report. Other statements were also criticised.

L. H. Scherck, of Newburg, said that he did not think the report would stand the criticism of competent gas men and suggested it be revised before being published.

E. L. Callahan, of Chicago, heartily endorsed the report, saying that it represented the results of commercial tests. He did not think it was biased.

G. S. Barrows, of Philadelphia, supported Mr. Scherck in his statement that the report should be revised.

After further brief discussion it was moved that the report be reviewed by a committee before being published. The motion was lost.

Mr. Quigley, of Brooklyn, spoke against the term "gas arc" used in the report. He also disapproved of other electrical terms used by gas men in referring to their devices. Mr. Gille closed the discussion, pointing out that the values given in the report are the same as those found in actual service.

The next business was the report of the Committee on Advertising and Publicity, which was presented by C. W. Lee, chairman.

ADVERTISING AND PUBLICITY.

This committee reports that it made an attempt to secure expressions from a large number of central stations as to the definite results secured from their advertising. The replies seemed to indicate that there are lacking definite constructive plans for advertising, the tendency being towards a haphazard use of newspaper space and a lack of continuity in the follow-up campaigns. The replies received are classified according to the population of the cities from which they were obtained and show that in cities of from 20,000 to 50,000 inhabitants the average advertising appropriation of the central station is $1,500; in cities of from 50,000 to 100,000 population the average is about $2,500 per year; of the replies received from stations in cities of from 100,000 to 200,000 population the annual appropriation is $6,300, and above 200,000, $31,000. The committee reports that the replies would indicate that over $2,000,000 is being expended annually for central-station advertising. Reports are given of the advertising campaign carried on in Baltimore, Brooklyn, Chicago and Cleveland, also by H. M. Byllesby & Company for its properties. Well-prepared newspaper advertising is preferred in every case with systematic follow-up systems. The report discusses central-station advertising by manufacturing companies and calls attention to the benefits of this co-operation. Regarding central-station publicity a large number of cases are cited where central-station publicity was the means of securing justice in rate, franchise and similar controversies. A valuable feature of this committee's report is the number of copy reproductions of some of the best central-station advertising and examples of central-station publicity that have proven successful.

H. K. Mohr, of Philadelphia, opened the discussion suggesting that the committee be made a clearing house which would offer its services to any company desiring service.

M. S. Seelman, Jr., of Brooklyn, spoke of the importance of regular and close association between the advertising and commercial departments of a central station.

F. H. Gale, of Schenectady, outlined a plan by which, upon central stations sending the names of people contemplating the erection of buildings to the manufacturing companies, the latter will in turn send such parties special and general literature describing electrical apparatus which may be profitably used by them.

J. Robert Crouse, of Cleveland, described the co-operative advertising campaign carried on in Cleveland. Douglas Burnett and Vice-Chairman Willams also briefly discussed the report.

The next report was that of the Committee on the Functions of a Sales Department, which was presented by P. I. Jones, chairman.

FUNCTIONS OF A SALES DEPARTMENT.

The report of the Committee on the Functions of a Sales Department, T. I. Jones, of the Brooklyn Edison Company, chairman, treats the organization of a sales department in great detail under four heads, namely: General organization of the selling force and the duties naturally pertaining to it; principal reports to be made by the sales department as a whole by its bureaus and by the salesmen; credit as it affects the getting and retaining of business; the compensation of salesmen. The selling-force organization is treated under the heads of advertising bureau, new-installation bureau, appliance bureau and power-engineering bureau. Under sales department the matter of reports is discussed in detail, and forms of reports are reproduced. Compensation of salesmen is discussed under the heads of straight salary, small salary and commission and straight commission. An appendix gives a schedule for solicitors' commissions as used by the Commonwealth Edison Company, of Chicago, which has an added interest on account of enumerations in detail of the various classes of electrical business. A schedule is also given of the Denver system of compensation based upon salary and commission.

The report was discussed by B. W. Mendenhall, Salt Lake City; William H. Gardner, Lincoln, Neb.; S. M. Kennedy, Los Angeles; C. Duffy, Milwaukee; Douglas Burnett, Baltimore; E. W. Lloyd, Chicago; C. A. Littlefield, New York, and J. D. Israel, Philadelphia. In general, the persons taking part in the discussion favored the abandonment of the term "sixteen-candle-power equivalents." The payment of straight salaries was also favored, although the combination of a salary and a commission was given some praise. Mr. Jones laid special stress upon the importance of paying good salaries to few men, rather than small salaries to many, and urged the merits of promotion from within the ranks. The importance of shortening the time elapsing between the signing of a contract and the turning on of the lights was also emphasized.

E. W. Lloyd, as chairman of the nominating committee, presented the following list of nominations for the ensuing year, which was unanimously accepted, after which the meeting adjourned:

Chairman, H. J. Gille, Minneapolis; vice-president, S. M. Kennedy, Los Angeles; secretary, F. B. Rae, New York. Executive committee, George Williams, New York; F. H. Gale, Schenectady; J. Robert Crouse, Cleveland; E. L. Callahan, Chicago; D. Campbell, Scranton; A. B. Rypinski, New York; E. W. Lloyd, Chicago; T. I. Jones, Brooklyn; Mr. Winter, Seattle; H. K. Mohr, Philadelphia; C. W. Lee, New York, and J. F. Becker, New York.

Accounting Section.

The second accounting session was held on Wednesday, John T. Brady opening the session with the reading of a paper dealing with the tracing of store-room material.

TRACING STOREROOM MATERIAL.

The growth of the electric industry, mentioned by Mr. Brady in his paper, has rendered necessary the storage of large quantities of material. This requires a system of records which will show figures as to receipts, disbursements, etc. It is necessary that an exact account should be kept of material and this can only be accomplished by properly training the employees in precise methods. The company represented by Mr. Brady is a model in this respect. Records should be provided for the entry of all material received and disbursed at the storeroom, and it seems that the best method of accomplishing this is by a loose-leaf system. All articles should be drawn from the storeroom by means of requisitions signed by the foreman of the different departments. The system of tracing material, as used by the Denver Gas & Electric Company, was described as one which had been followed with marked success. A work order is used on every job and, as the work is completed, the men are required to enter

on the back of the order the different material used. All material reported on work orders is entered daily upon the weekly wagon sheet, and can be used as a check on the stock-record ledger. Electric supplies were taken up separately as presenting some problems different from those of the operation of ordinary business. A lamp clerk is employed to keep records of all lamps and account for them. Provisions are made for the use of slightly blackened lamps which are returned, these also being accounted for. Fans are rented and sales-tickets made out, a charge being made for the gross amount from the sales-ticket to the sales-appliance book. Electric irons are placed on thirty days' trial, which encourages the use of the irons, and also brings considerable off-peak load to the station. The company experiences no difficulty in keeping track of the iron stock, although the loan account amounts to 5,000 irons each year. The system of taking an inventory each year has been abandoned in favor of the more modern scheme of taking an inventory of a part of the stock each month. Greater accuracy is obtainable in this manner.

In dicussion, E. S. Brock stated his opinion in favor of the bound ledger as against a loose-leaf system of keeping accounts. He also outlined the method followed by some of the larger central stations in connection with keeping account of material taken out by store-room wagons. With this system, all material taken out is checked, the returned stores being checked back to the store-room at night.

W. H. Bogart, of the New York Edison Company, mentioned the fact that that company had various distributing store-rooms, supplied from the general store-room. Material could only be drawn out on the foreman's order. All material is double checked. The material is divided into classes and inventories are taken about once a month. Moving supplies are checked twice a week.

The method of the Commonwealth Edison Company of keeping account of stores was briefly outlined by J. H. Gulick.

The discussion was closed by Mr. Brady, who answered the questions that had been asked concerning his paper.

A paper was then read by Thurlow W. Buxton on "Purchasing Department Accounting," which was taken from the point of view of accounting, rather than purchasing.

PURCHASING DEPARTMENT ACCOUNTS.

In this paper Mr. Buxton confined his attention to a discussion of the aims and methods of the accounting connected with the purchasing end of the central-station industry. As outlined by Mr. Buxton, the function, in general, of the purchasing department is to purchase and care for supplies and apparatus used and sell what is desirable to dispose of; but the aims and methods employed in operating the machinery of the office necessary to handle large purchases, and the problems thereto form the features of its accounting. The purchasing department of the Brooklyn Edison Company consists of three divisions: order, invoice and transportation. The storeroom and stationery divisions are under the jurisdiction of the purchasing agent, and the lamp bureau reports to the storekeeper. The stores department, as well as the lamp bureau, possess accounting features peculiarly their own, and their organization and systems of accounts have been considered in convention papers of previous years. The aims in distinctive purchasing accounting were summarized as follows, each item being taken up separately for discussion: (1) To close the purchase properly; (2) to verify receipt of the purchase; (3) to verify the resulting expenditure, with a minimum of dispute or delay; (4) to care for special and miscellaneous matters; (5) to provide its peculiar statistics, and ready information; (6) to handle the sale of certain materials. A number of accounting forms were used in the elucidation of various points.

Mr. Brady outlined the method employed by the Denver Gas & Electric Company for preventing mistakes involving the second payment of a bill. Such mistakes are avoided through a triplicate form of ordering, one copy going to the firm from which the goods are ordered, one to the purchasing agent, and the third to the department ordering the goods.

The point of the importance of prompt payment of bills, with the attendant discount, was touched upon by E. A. Barrows, who suggested that there should be some discussion as to the way in which the bills were handled.

The uniform bill system was taken up by Mr. Allegaert, and further discussed by Mr. Edwards, Mr. Freeman, D. C. Collins and others.

Mr. Buxton then added a few remarks answering the questions that had been raised in the discussion.

A. L. Holmes' paper on "Advantage of a Job Cost System" was then read.

ADVANTAGES OF A JOB-COST SYSTEM.

This paper advocates the job-cost system for all construction work carried on by a central-station company. Through its use there is provided a requisition with sufficient description of any proposed expenditures and an estimate of cost, which, when approved, can be given an identifying nnmber, all cost assembled thereunder and, upon completion, a comparison of actual with estimated cost. Cost data gradually obtained through use of job orders will obviously make estimating of cost much simpler, according to the author, and more reliable, and greater care will be exercised in preparation of estimates because of the knowledge that comparisons will be made with actual costs when work is completed. It will also add to the probability of having work done as specified in estimate, and if unforeseen conditions be encountered, particularly if involving additional expenditures, such conditions will be brought to the attention of the proper officials. Where it is a common practice, as in street extensions or repairs, to take out for use, wire, cable and sundry material in excess of actual requirements, the certainty that estimated and actual costs will be compared will be sure to secure a better return of any excess material or a proper record of its transfer to other jobs. Comparisons of actual with estimated cost will also often lead to the detection of purely clerical errors as in quantities of material charged, or in prices, extensions and additions. The advantages of a job-order system to the accounting department were also mentioned. The paper concludes with an example of the application of the job-order system to actual work.

The question was raised by Mr. Schmidt as to whether the cost of line installation was kept for each individual service. The same question was asked regarding the setting of meters. J. W. Brennan, of Detroit, stated that in that place the work-order system was carried out in detail, each order being numbered and carefully accounted for. A similarly complete carrying out of the job system is found in the Doherty Operating Company, as outlined by Paul Jones.

Another question, that of construction work, was brought up by E. J. Bowers, who asked Mr. Holmes to explain how in reconstructing line and doing similar work the proportion was determined which should be charged to amortization.

In connection with the proper and exact keeping of accounts, Mr. Edwards spoke of the requirements of the Public Service Commission, of New York, and the necessity for all companies having the exact information which a commission might require.

Following Mr. Edwards, Herman Spoehrer, of St. Louis, dwelt on the value of the work-order system in the company in that city. Work orders are carried along monthly in a special account and when a job is finished monthly comparisons are easily available.

THIRD SESSION.

The third accounting session held on June 1 was opened by a paper by Franklyn Heydecke on "General Office Accounting."

GENERAL OFFICE ACCOUNTING.

Mr. Heydecke emphasized the importance of a properly organized accounting department and took up briefly the subject of its relations with other departments of the central station. It is important that the men in the accounting department have not only a general knowledge of the work of the company, but a wide acquaintance with the operating men, and men in the other departments. Monthly statements are of prime importance, and it is better for the accounting department to furnish the executive and operating men with a statement showing total charges for the month for production, labor, production supplies, station expense, fuel, oil and waste, repairs, etc., and the commercial men with a statement showing total charges against expense collection, expense office, office salaries, indexing meters, expense soliciting, house-wiring expense, motor expense, etc., than it would to go into the detail of showing what made up each account in particular. Analyzing of accounts can be done later when found

necessary. If an account shows the same amount or a slight increase, and compares favorably with the same period of the previous year, it does not require analyzing, and it is only when charges are unusually heavy or the reverse, when the charges are not reasonably heavy enough, that analysis is required. Mr. Heydecke then outlined the procedure of the general office accounting to arrive at the above facts.

Discussion was opened by Herman Spoehrer, who explained the method of making out the office vouchers. In the matter of handling bills promptly, he stated his company has established the practice of having two discount days each month. The work is thus divided up in a more even manner throughout the month.

The necessity of close touch between the accounting department and all other departments was the basis of a continuation of the discussion by Frank Birch. He stated that it was desirable for this reason to keep employees in the service of the company, as an acquaintance with the personnel of the company could not be acquired in a short time. He further made a number of suggestions and several inquiries on points in Mr. Heydecke's paper.

W. E. Freeman commented on the excellence of the paper at the same time outlining the points necessary for proper accounting. The New York Edison Company has introduced indexed forms which give in a classified way all the transfers and journal entries, and which are required by the Public Service Commission, and are besides necessary for the company. The duties of the staff auditor in properly carrying out accounting work were also outlined.

A paper entitled "Accounting for Depreciation," was then read by Mr. Edwards.

ACCOUNTING FOR DEPRECIATION.

This paper deals with the question of how the amount to be reserved for depreciation should be determined and how the reserve should be treated in the accounts. The amount may be determined by the specific method or the general method. The specific method inventories the property, listing the cost, scrap value, life, etc., of each item. Scrap value and life are largely conjectural. This method is objectionable because it endeavors to treat with exactness a subject necessarily inexact and because it cannot take account of obsolescence. The general method creates a reserve arbitrarily taking a fixed percentage of the value of the property, a fixed percentage of gross receipts, or a definite amount from the surplus. This can only be approximate. The New York Edison Company started its depreciation fund upon incorporation in 1901, and laid aside one cent per kilowatt-hour sold to general customers. This has proved an adequate reserve. In accounting, this reserve is treated as an item of operating expense, in conformity with the idea that the consumer bears this item of expense, and it should not be regarded as an appropriation from surplus. This is in accordance with the principles and the prescribed practice of the New York Commission. Depreciation in all departments of plant is treated as one item. Having accumulated a reserve for depreciation, it is not necessary for a company to charge off annually a portion of the costs; the property account can be carried at the original figures. This plan simplifies the accounting. Any member company which has not yet provided a depreciation reserve fund should do so at once, as a day of reckoning will soon arrive. The New York Commission requires a company not previously holding a reserve fund to charge against it only that part of depreciation which has occurred after the fund was started; the remainder must be charged to the surplus account.

Following the reading of the paper, a statement was made by Mr. Neal that there was only a small percentage of the companies reporting to the Public Service Commission, of New York, that made any allowance for amortization. The reports as made by the Commission were a little misleading, and suggested that that body should pay closer attention to the item of amortization. He also suggested that depreciation could be taken care of by making it on a sinking fund basis.

E. J. Allegeart raised the point that whether or not public service commissions would recognize that replacements are not proper subjects for capitalization unless the thing replaced is first written off, he still personally believed that they were not. A plant, or a large part of it at least, he stated, is eventually consumed in the process of manufacture; and this extinction is an element of the true cost of conducting the business. There can be no question, therefore, that it should appear on the books. The writing into the books of this cost, automatically, so to speak, creates a reserve, which, looking at it from another standpoint, is, in effect, a credit to the plant account.

C. Nesbitt Duffy, in discussion, gave an idea of how the question of depreciation was being met by the Milwaukee Electric Railway & Light Company. With that company, ten per cent of the gross earnings is set aside, and against that reserve is charged every replacement, renewal and substitution, or any thing which might be termed putting back of any kind of property in the place of what was there before. He continued, holding that to undertake to work out a sinking fund basis on a life table of different classes of physical property, was absolutely impracticable.

William B. Jackson urged the acceptance of the best of all methods, rather than adherence to any one. Contrary to Mr. Duffy's statements, he maintained that plants can take care of depreciation, and must take care of depreciation as it is worked out for the plant; and it has got to be worked out carefully and intelligently. That, he said, must either be the case, or our leaders in the electrical industry must change their present beliefs which are founded on careful investigation by our commissions which have already been developed and are going to develop very rapidly in the future.

Following the discussion, resolutions were adopted expressing sympathy with the family of R. D. Rubright, of Brooklyn, deceased.

A paper on "The Extent to Which a Tabulating Machine May Be Used in Accounting Work" was read by William Schmidt, Jr.

TABULATING MACHINES IN ACCOUNTING WORK.

Of late a number of mechanical devices have come into use in connection with the keeping of central-station accounts and statistics, of which some are described in Mr. Schmidt's paper. The number of mechanical devices used in connection with the keeping of records is so large that a view of the room in which these devices might be gathered would resemble a factory having for its product cost statements, statistics and balance sheets. The author took up each machine separately, dealing first with the tabulating machine. The various parts of the machine were described together with the method of operation. The information taken from the cards is used for statistical records for balancing the number of meters in service, etc. By the use of the machine the monthly bills may be checked quickly and at a very small expense. The adding machine is very useful and with its aid boys may be employed, doing away with a considerable amount of higher grade labor. The company has found that it pays to keep at least one adding machine in each department where there is any adding or listing to be done, and it is found that such machines are in constant use. The calculating machine is used especially for calculating the cost per kilowatt-hour in cost statements and for extending inventories, etc. The use of this device is growing rapidly. The author also touched on the necessity of the typewriter and addressing machine. Printing machines are useful in large central stations, for running off duplicate letters. The rubber stamp, change making and sealing machine, electric envelope sealer, and numbering machine were each taken up and discussed separately.

The paper was discussed by Paul R. Jones and also by Harry C. Schlegel, Mr. Jones stating that the tabulating machines were invaluable to those wishing a systematic analysis of their business, and giving a brief instance of their use in the Denver Gas & Electric Company. Mr. Schlegel added that in the New York Edison Company statistical data are obtained of the length of service of each employee, their pay, age, etc.

Convention Notes.

It was fitting indeed that the record-making thirty-fourth convention of the National Electric Light Association should have been opened so auspiciously upon the occasion of the reception at the Hotel Astor on Monday evening. The receiving party, consisting of President and Mrs. W. W. Freeman, Vice-President and Mrs. John F. Gilchrist, Vice-President and Mrs. F. M. Tait, General Geo. H. Harries, treasurer and T. Commerford Martin, secretary, entertained a brilliant assemblage in the grand ball room. The organ recital by Arthur Depew was greatly enjoyed. The promenade concert on the roof garden which followed was greatly appreciated, the manifestations of delight upon the part of all those participating amply repaying the committee for the great efforts which have been made to render the appointments so complete. Dancing followed and there was a collation in the orangery of the hotel.

THE CATALOG EXHIBIT.

A number of Class "D" members made a very interesting exhibit of catalogs, a great many pieces of trade literature being shown. To facilitate the examination of this exhibit there was a very complete file, cross-indexing each piece of literature, making it possible to locate any of the printed matter asked for. The exhibit was in charge of the Exhibition Committee, J. C. McQuiston, chairman; Walter Neumuller, secretary. Following is a list of the exhibitors in the catalog exhibit:

Allis-Chalmers Company, Milwaukee, Wis.
American District Steam Company, Lockport, N. Y.
Ansonia Brass & Copper Company, New York, N. Y.
Baker Motor Vehicle Company, Cleveland, Ohio.
Benjamin Electric Manufacturing Company, Chicago, Ill.
Bryant Electric Company, Brideport, Conn.
Century Electric Company, St. Louis, Mo.
Crocker-Wheeler Company, Ampere, N. J.
Crouse-Hinds Company, Syracuse, N. Y.
Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
D. & W. Fuse Company, Providence, R. I.
Dearborn Drug & Chemical Works, Chicago, Ill.
Dossert & Company, New York, N. Y.
Electric Heat Storage Company, New York, N. Y.
Electric Journal, Pittsburg, Pa.
Electric Storage Battery Company, Philadelphia, Pa.
Electrical Review and Western Electrician, Chicago, Ill.
Electrical Testing Laboratories, New York, N. Y.
Electrical World, New York, N. Y.
Emerson Electric Manufacturing Company, St. Louis, Mo.
Federal Sign System, Electric, Chicago, Ill.
G. & W. Electric Specialty Company, Chicago, Ill.
General Electric Company, Schenectady, N. Y.
General Vehicle Company, Long Island City, N. Y.
Greenwood Advertising Company, Knoxville, Tenn.
Griscom-Spencer Company, New York, N. Y.
Hart Manufacturing Company, Hartford, Conn.
Hubbard & Company, Pittsburg, Pa.
Johns-Manville (H. W.) Company, New York, N. Y.
Metropolitan Engineering Company, Brooklyn, N. Y.
Mineralac Electric Company, Chicago, Ill.
Moloney Electric Company, St. Louis, Mo.
Morris Iron Company, New York, N. Y.
National Carbon Company, Cleveland, Ohio.
National Electric Lamp Association, Cleveland, Ohio.
Nernst Lamp Company, Pittsburg, Pa.
Otis Elevator Company, New York, N. Y.
Pacific Electric Heating Company, Ontario, Cal.
Pettingell-Andrews Company, Boston, Mass.
Philadelphia Electric & Manufacturing Company, Philadelphia, Pa.
Pittsburg Transformer Company, Pittsburg, Pa.
Pittsburg Reinforcing Pole Company, Pittsburg, Pa.
Popular Electricity Magazine, Chicago, Ill.
Public Service Publishing Company, Chicago, Ill.
Ricker Manufacturing Company, Rochester, N. Y.
Ridgway Dynamo & Engine Company, Ridgway, Pa.
Sangamo Electric Company, Springfield, Ill.
Simplex Electric Heating Company, Cambridge, Mass.
Standard Underground Cable Company, Pittsburg, Pa.
Triumph Electric Company, Cincinnati, Ohio.
Vacuna Sales Company, New York, N. Y.
Vulcan Electric Heating Company, Buffalo, N. Y.
Wagner Electric Manufacturing Company, St. Louis, Mo.
Waverly Company, Indianapolis, Ind.
Wesco Supply Company, St. Louis, Mo.
Western Electric Company, New York, N. Y.
Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.
Weston Electrical Instrument Company, Newark, N. J.

STEAMBOAT RIDES.

On Tuesday morning about 500 ladies were entertained by a steamboat ride up the Hudson River. The weather was just right for an occasion such as this, and the magnificent scenery on both sides of the river was at its best. On Tuesday evening practically all those in attendance at the convention enjoyed a boat ride down New York Bay to Coney Island. There was a good opportunity to inspect the sign lighting along the river and the trip was greatly enjoyed. The fact that Dreamland had been entirely destroyed proved a great disappointment to many who had looked forward to an inspection of this famous resort.

INTER-MEETING BULLETIN BOARD AND TELEPHONE CALL.

One of the very sensible features of this convention was the announcement board which was arranged to facilitate those in attendance at the meetings in several parts of the Engineering Societies Building to keep in touch with the proceedings at each of the sessions. In each of the assembly rooms there was a bulletin board service by means of which the name and subject of each speaker in each of the other assembly rooms were continuously displayed. The bulletin board was devised by John Lambden and Secretary T. C. Martin.

Another interesting feature installed by Superintendent Lambden was a system of telephone calls. Whenever a telephone call was received the delegate's name was written on a glass slide, transmitted by a messenger to a special projecting lamp located at the rear of the auditorium, the name then being thrown silently upon the front wall or screen in letters of light giving full directions to the desired party in regard to the location of his call.

CONVENTION DAILY.

The *Convention Daily* published five splendid issues, keeping the delegates in close touch with the proceedings, the entertainment features, the social events, and news items of the convention season. The *Daily* was published through the courtesy of the *Electrical World* for the National Electric Light Association. The genius of the *Daily* was our old friend, W. E. Keily, supported by an active and capable staff.

On Wednesday at noon, James H. McGraw, president of the McGraw Publishing Company, was the host at a luncheon given by the *Electrical World* in the yacht room of the Hotel Astor, to the officers of the Association. Among those present were W. W. Freeman, president; John F. Gilchrist, vice-president; Frank M. Tait, second vice-president; T. C. Martin, secretary; Past-Presidents W. H. Blood, Jr., Arthur Williams, Dudley Farrand and F. W. Frueauff; A. A. Dion, president of the newly-affiliated Canadian Electrical Association; Hugh M. Wilson, first vice-president, and A. E. Clifford, second vice-president of the McGraw Publishing Company; W. D. Weaver, editor of the *Electrical World*, and the members of the staff of the *Convention Daily*.

BASEBALL GAME POSTPONED.

Greatly to the regret of the baseball enthusiasts of the association, the "all-electric" game which was to have been played at Washington Park, Brooklyn, Wednesday was abandoned owing to a steady downpour of rain. Considerable interest had been worked up for this baseball game, particularly as the Westinghouse Electric & Manufacturing Company had presented as a baseball trophy a handsome three-handled, sterling-silver loving cup standing nearly twelve inches high. This was to have been contested for by the teams.

PORTRAIT OF MISS BILLINGS.

One of the delightful incidents of the convention in connection with the presentation of the portrait of Miss Billings by Henry L. Doherty to the Association, was the telegram which was transmitted to Miss Billings at Arlington, Vt., by a committee comprising Paul Doty, W. C. L. Eglin and T. C. Martin. The telegram was as follows: "Your boys—and they are many to-day—knowing your thoughts of them, want you to know ours are with you. The day has been made memorable by the possession of your splendid portrait. We all send sincere regards and best wishes for continuous happiness, now and to come. By unanimous instruction of the convention."

THE BYLLESBY DINNER.

One of the events on Friday evening was the dinner given by H. M. Byllesby, of Chicago, at the Metropolitan Club to the delegates of H. M. Byllesby & Company, and the affiliated companies attending the convention. Among the guests were C. A. Coffin, Samuel Insull, S. Z. Mitchell, Wm. C. Lane, S. W. Childs and T. C. Walcott. The company men present were J. J. O'Brien, F. W. Sterns, Samuel Kahn, T. K. Jackson, J. W. J. Gillett, H. C. Hoagland, W. F. Raber, L. G. Gresham, Harold Almert, E. L. Callahan, W. F. Stevens, Jr., and Wm. H. Hodge.

MEETING OF CLASS "D" MEMBERS.

The Class D members of the Association held their annual meeting on Friday. J. C. McQuiston, of the Westinghouse Companies, chairman of the Exhibition, presided, Walter Neumuller, secretary and treasurer of the Class D section presenting the minutes of the last meeting and reading his treasurer's report. The matter of the Seattle convention next year was discussed, with respect to the advisability of holding an exhibit on the Pacific Coast in 1912. It was the consensus of opinion that while there would be difficulties in the transportation of apparatus to the Coast, nevertheless a convention there would afford an opportunity for introducing many manufacturers to a new circle of friends and purchasers in the extreme Northwest. The nominating committee after a brief conference favored extending the term of the outgoing members of the Exhibition Com-

mittee, and they were re-elected for the 1912 terms as follows: J. I. Ayer, Simplex Electric Heating Company; Charles Blizard, Electric Storage Battery Company; H. G. McConnaughy, Dearborn Drug and Chemical Works.

J. G. WHITE DINNER.

J. G. White & Company, Inc., gave a dinner at the Hotel Astor during the convention in honor of the visiting officials connected with the companies of which J. G. White & Company, Inc., are operating managers.

MUSICALE FOR THE LADIES.

The musicale for the ladies in the grand ball room at the Waldorf-Astoria on Thursday was attended by a about 300. The Misses Hoyt rendered a number of very pleasing selections in costume.

THE COMMERCIAL SECTION BANQUET.

The Commercial Section banquet was given on Thursday at midnight, there being about 150 committee chairmen, committee members, manufacturers, representatives of electrical journals, and others interested in the Section present. The banquet was given by J. Robert Crouse and George Williams, and from the beginning to the end enthusiasm was supreme. A feature of the banquet was the presentation of a beautiful sterling-silver loving cup, the gift of Mr. Crouse, for the member of the Commercial Section who succeeded in bringing in the greatest number of applications for membership. The cup was won by A. S. Huey, vice-president of H. M. Byllesby & Company, Chicago, with 107 applications, close pressed by George Williams himself with 106. In introducing the award of the cup, President Freeman stated that he knew of no other two men who would have the nerve to do such a thing as this—for one of them to present a cup and the other to try to win it. There was a delightful repast and brief addresses made by J. Robert Crouse, Secretary T. C. Martin, John F. Gilchrist and F. M. Tait. In accepting the cup for Mr. Huey, who was unavoidably absent, Errett L. Callahan made a graceful speech in which he attested the high regard for the commercial spirit which is manifested by the Byllesby organization, and promised on behalf of them a continuance of every effort to increase the influence of the Commercial Section.

PRESIDENT FREEMAN'S DINNER.

President W. W. Freeman invited the officers and several others prominent in the administration of the National Electric Light Association, and the Hon. Charles Nagel, secretary of the United States Department of Commerce and Labor, to dine with him at the Lotos Club Wednesday evening, May 31. A delightful repast was served in good time for the entire party to go to the New Theater and listen to the report of the Public Policy Committee of the Association and the addresses by Mr. Insull and Mr. Nagel. Several of the visitors to the Lotos inspected the beautiful new club house and expressed appreciation of its works of art and excellent club facilities.

Among those present, in addition to the host, were: Hon. Charles Nagel, Hon. George B. Cortelyou, Nicholas F. Brady, H. M. Byllesby, Samuel Insull, Gen. George H. Harries, T. C. Martin, W. H. Blood, J. W. Lieb, Jr., F. W. Frueauff, J. B. McCall, John F. Gilchrist, William McCarroll, R. S. Hale, Arthur Williams, Thomas E. Murray, F. M. Tait and E. W. Burdett.

MR. SAWYER'S DINNER.

L. P. Sawyer, of Cleveland, Ohio, the well-known and popular president of the Buckeye Electric Company, entertained several of his friends at dinner at Rector's on Wednesday evening. It was a very delightful affair, with artistic menus and ice designs, and a special musical program was rendered. This was one of the several particularly agreeable gatherings during the convention of the National Electric Light Association, and will always be remembered with the keenest pleasure by every one present. Mr. Sawyer's guests were: A. H. Ford, Birmingham, Ala.; P. T. Glidden, Easton, Pa.; P. R. Whiting, Montgomery, Ala.; J. H. Drake, Knoxville, Tenn.; W. H. Sawyer, New York City; S. H. Dailey, Binghamton, N. Y.; D. A. Hegarty, Little Rock, Ark.; M. S. Sloan, Birmingham, Ala.; William R. Huntley, Buffalo, N. Y.; J. Robert Crouse, Cleveland, Ohio; J. E. Montgomery, Niagara Falls; S. E. Doane, Cleveland, Ohio; R. S. Orr, Pittsburg; Charles W. Price, New York City.

LUNCHEON TO THE ELECTRIC-VEHICLE REPRESENTATIVES.

Arthur Williams presided at a luncheon tendered by the New York Edison Company to the representatives of the electric-vehicle manufacturers, on Thursday, June 1. The luncheon was served in the new Grand Central Palace, where the New York Electrical Show is to be held next fall, and lasted from 1 to 3 p. m. During the discussion of the meal addresses were made by Mr. Williams and Messrs. Price, Kennedy, Wetherby, Kenworthy, Howland, Donaldson, Foljambe and Rice. An unusual spirit of enthusiasm respecting the development of the electric vehicle in the central-station field was in evidence in all the remarks made. The special facilities which will be available for demonstrating the handling and operation of electric vehicles exhibited at the coming Electrical Show were commented on most favorably.

Among those present were: Arthur Williams, New York Edison Company, New York City; Albert Weatherby, Anderson Electric Car Company, New York City; F. A. Babcock, president, Babcock Electric Carriage Company, Buffalo, N. Y.; E. W. M. Bailey, vice-president, S. R. Bailey & Company, Amesbury, Mass.; W. C. Brown, W. R. Bailey & Company, New York City; H. W. Nuckels, Columbia Motor Car Company, Hartford, Conn.; C. E. Firestone, Columbus Buggy Company, Columbus, Ohio; E. S. Harte, Commercial Truck Company, of America, Philadelphia, Pa.; J. H. Kennard, president, Couple Gear Company, New York City; H. G. Brentlinger, secretary and treasurer, Dayton Electric Car Company, Dayton, Ohio; C. J. Field, president, Electric Omnibus & Truck Company, New York City; P. D. Wagoner, president, General Vehicle Company, Long Island City, N. Y.; O. B. Henderson, sales manager, Baker Motor Vehicle Company, Cleveland, Ohio; Bruce Borland, pres-

BANQUET GIVEN BY J. ROBERT CROUSE AND GEORGE WILLIAMS TO COMMITTEEMEN OF COMMERCIAL SECTION AND INVITED GUESTS.

ident, Ideal Electric Vehicle Company, Chicago, Ill.; Nathaniel Platt, Baker Vehicle Company, New York City; Gen. W. M. Healey, Healey & Company, New York City; Harwood Bacon, general manager; R. C. H. Sales Company, Detroit, Mich.; C. L. F. Wieber, Rauch & Lang Carriage Company, Cleveland, Ohio; C. Y. Kenworthy, Rauch & Lang Electric Company, New York City; Col. G. F. Studebaker, Studebaker Automobile Company, South Bend, Ind.; C. F. Redden, Studebaker Automobile Company, New York City; Charles A. Ward, Ward Motor Vehicle Company, New York City; H. H. Rice, Waverley Company, Indianapolis, Ind.; Dunham Wheeler, Waverley Electric Vehicle Company, New York City; W. H. Conant, Washington Motor Car Company, Washington, D. C.; Louis E. Burr, Woods Motor Vehicle Company, Chicago, Ill.; C. E. Humphrey, Woods Motor Vehicle Company, New York City; C. L. Morgan, Newark, N. J.; George F. Parker, New York City; J. M. Lamsden, Jr., New York City; Frank A. Whitton, The Lansden Company, Newark, N. J.; H. P. Dodge, Ohio Electric Car Company, Toledo, Ohio; Thomas J. Fay, *The Automobile*, New York City; Burton S. Brown, *The Globe*, New York City; Harmon O. Cox, *New York Commercial*, New York City; Duncan Curry, *New York American*, New York City; H. F. Donaldson, *Commercial, Vehicle*, New York City; H. C. Cushing, Jr., *Central Station*, New York City; John R. Eustis, *Evening Mail*, New York City; E. S. Foljambe, *Commercial Car Journal*, Market and Forty-ninth Streets, Philadelphia, Pa.; A. A. Gray, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago, Ill.; Ellis L. Howland, *Journal of Commerce and Commercial Bulletin*, New York City; E. F. Karbel, New York City; C. Scharpe, *New York Sun*, New York City; Charles E. J. Lang, Rauch & Lang Carriage Company, Cleveland, Ohio; Peter Dumont, New York City; Uri B. Grannis, Ideal Electric Vehicle Company, Chicago, Ill.; A. C. Moses, Washington Motor Vehicle Company, Washington, D. C.; R. McA. Lloyd, General Vehicle Company, Long Island City, N. Y.; Charles W. Price, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, New York City; George D. Smith, New York City; A. A. Pope, C. A. Littlefield, F. H. Kinnicutt, Cyril Nast, R. N. Clyde, W. P. Kennedy, New York Edison Company, New York City.

THE SONS OF JOVE REJUVENATION AND DINNER AT CONEY ISLAND.

The Sons of Jove held a splendid rejuvenation at Reisenweber's Casino, at Coney Island, on Friday evening. There were 110 novices initiated into the order. The dinner began at 6:30 p. m., T. I. Jones, of the Brooklyn Edison Company, New York statesman, presiding. The rejuvenation was presided over by Reigning Jupiter J. F. Dostal, of the Denver Gas & Electric Company, assisted by an expert team under the direction of A. S. DeVeau, of Brooklyn. This was indeed one of the most brilliant and satisfactory joviations ever held, and the Committee of Arrangements, headed by Joseph F. Becker, deserves the heartiest commendations of all Jovians.

The Thursday evening entertainment included theatre parties at the Lyric, where "Everywoman" was presented; the Broadway, with Lew Field's "Henpecks," and a variety show at the Winter Garden.

The entertainment features of the week were concluded with a boat trip on Saturday, at which the members and ladies were the guests of the New York Edison Company. Visits were made to the generating stations of the company, the plant of the Interborough Rapid Transit Company and the works of the Consolidated Gas Company.

The lack of collective exhibit facilities made it a little more difficult for the manufacturers to get in touch with their central-station friends. However, there was no lack of enterprise and the Class D membership was splendidly represented by manufacturers from all over the country. The Hotel Astor was a scene of a great many gatherings and as this was practically the hotel headquarters of the convention some of the leading manufacturers had elaborate reception rooms, and, in some cases, conspicuous exhibits located therein. The Westinghouse Electric & Manufacturing Company, The Wagner Electric Manufacturing Company, the Kerite Insulated Wire & Cable Company, the Western Electric Company, the Okonite Company, John A. Roebling's Sons Company, maintained hotel headquaters. The General Electric Company and the Holophane Company occupied commodious suites of offices opposite the Engineering Societies Building, and the Weston Electrical Instrument Company also maintained a very interesting exhibit of electrical measuring apparatus in a building across the street from the convention headquarters. This exhibit consisted of a complete equipment in operation, and of instruments dismantled and placed in glass cases for inspection.

The American Conduit Manufacturing Company was repesented by its vice-president and general manager, the genial and universally-esteemed H. B. Kirkland.

The Pittsburg Transformer Company was represented by R. V. Bingay and H. G. Steele.

The Sangamo Electric Company was represented by R. S. Lanphier and H. W. Young.

The Detroit Fuse & Manufacturing Company was represented by its secretary and treasurer, Alpha H. Kling.

The United States Light & Heating Company was well represented by A. H. Ackerman, A. Russell and members of the staff.

The Allis-Chalmers Company was represented by W. M. S. Miller, E. T. Pardee, Mr. Chilton and a number of branch-office managers.

The National Carbon Company was represented by N. C. Cotabish, C. W. Wilkins and J. C. Crider.

The Edison Storage Battery Company was represented by W. W. Bee.

The Electric Storage Battery Company was represented by Herbert Lloyd, Charles Blizard and G. H. Atkin.

The Okonite Company was represented by Willard L. Candee, George Manson, Lewis G. Martin and Romaine Mace.

John A. Roebling's Sons Company was represented by Marston Cockey.

The Kerite Insulated Wire & Cable Company was represented by a good delegation headed by W. R. Brixey.

G. M. Gest, the well known conduit engineer and contractor, was a busy man at the convention, assisted by W. T. Jackson.

The Western Electric Company was represented by E. W. Rockefellow, F. X. Cleary, H. C. Owens, and a host of others from every part of the country.

The Bryan-Marsh Company was represented by George G. Lockwood and E. H. Haughton.

The Banner Electric Company was represented by N. L. Norris.

The Brilliant Electric Company was represented by H. H. Cudmore and W. C. Wing.

The Sterling Electrical Manufacturing Company was repesented by William Coale.

The Fostoria Glass Specialty Company was represented by E. O. Cross.

The Warren Electric & Specialty Company was represented by C. O. Brandel.

The General Incandescent Lamp Company was represented by H. C. Rice.

The Tungstolier Company was represented by E. J. Kulas.

The Phoenix Glass Company was represented by A. H. Patterson.

The Adams-Bagnall Electric Company was represented by C. L. Eshleman.

The General Vehicle Company was represented by P. D. Wagoner, F. H. Vail and a number of others.

The Philadelphia Electric Storage Battery Company was represented by F. S. Marr.

The General Electric Company was represented by Frank H. Gale, F. C. Bates, D. B. Rushmore, C. W. Stone, T. Beran, J. Scribner, A. D. Page, F. W. Wilcox, W. H. Coleman, and a big delegation from the sales offices all over the country.

The Westinghouse Electric & Manufacturing Company was represented by J. C. McQuiston, G. Brewer Griffin, M. C. Rypinski, C. F. Scott, and an efficient corps of engineers and branch managers.

The Wagner Electric Manufacturing Company was ably represented by a big staff headed by W. A. Layman and Ray D. Lillibridge. The Wagner Company contributed largely to the success of the convention trains from the West, distributing train directories of the delegates en route, Wagner refreshments for the gentlemen, and favors and candy for the ladies.

The Triumph Electric Company was represented by W. H. Jacobs.

The Fort Wayne Electric Works was represented by F. S. Hunting and a number of others.

The Hart Manufacturing Company was represented by H. H. Hart, R. L. Jaynes, Pittsburgh representative, was also in attendance. Mr. Jaynes also represented American Conduit Manufacturing Company and the Bossert Company.

The D & W Fuse Company was repesented by W. S. Sisson.

H. W. Johns-Manville Company was represented by J. W. Perry, H. M. Frantz, V. A. Saylor, W. E. Rapp, D. Fitts, E. C. Cameron, S. G. Meek, J. R. McLain, H. M. Slauson, A. D. Miles, E. B. Hatch and R. C. Cole.

The Philadelphia Electric Manufacturing Company was represented by C. L. Bundy.

The Speer Carbon Company was represented by John S. Speer.

The Archbold-Brady Company was represented by W. K. Archbold.

It is impossible to include in the scope of these notes a specific reference to the host of good people who were presnt, and the following list is appended as a partial directory of the prominent ones who took an active part during the week.

Abbott, W. L., Commonwealth Edison Company.
Acker, Charles H., Philadelphia Electric Company.
Ackerman, A. H., U. S. Light & Heating Company.
Adams, Prof. C. A., Boston Edison Company.
Aldred, J., Commonwealth Edison Company.
Allegaert, E. J., Public Service Electric Company.
Allen, A. S., Tonawanda Power Company.
Allen, L. B., Westchester Lighting Company.
Allen, M. W., National Carbon Company.
Almert, Harold, H. M. Byllesby & Company.
Ames, Azel, Kerite Insulated Wire & Cable Company.
Anderson, Alf. E., Albert & J. M. Anderson Manufacturing Company.
Andrews, Wm. C., The Rae Company.
Archbold, W. K., Archbold-Brady Company.
Ashe, Sydney W., General Electric Company.
Atkin, G. H., Electric Storage Battery Company.
Ayer, James I., Simplex Electric Heating Company.
Bache, John, Morris Iron Company.
Bailey, Jno. L., Consolidated Gas, Electric Light & Power Company.
Baird, C. C., H. B. Camp Company.
Baldwin, F. S., Pass & Seymour.
Barnes, H. H., Jr., General Electric Company.
Bates, Fredk. C., General Electric Company.
Bauder, Paul F., National Electric Lamp Association.
Becker, Joseph F., United Electric Light & Power Company.
Bell, E. H., Mahoning & Shenango Railway & Light Company.
Benjamin, R. B., Benjamin Electric Manufacturing Company.
Bensel, Arlington, Driver-Harris Wire Company.
Beran, T., General Electric Company.
Berry, A. Hall, D. & W. Fuse Company.
Bingay, R. V., Pittsburgh Transformer Company.
Birge, N. R., General Electric Company.
Blackburn, Frank L., Doherty Operating Company.
Blake, S. H., General Electric Company.

Blizard, Chas., Electric Storage Battery Company.
Blood, W. H., Jr., Seattle Electric Company.
Blumenhauer, C. H., Jefferson Glass Company.
Boileau, W. E., Chattanooga Railway & Light Company.
Boynton, Napoleon H., National Electric Lamp Association.
Brady, A. N., Consolidated Gas Company.
Brady, John T., Denver Gas & Electric Company.
Brady, N. F., New York Edison Company.
Brady, Nicholas F., Yonkers Electric Light & Power Company.
Brady, T. D., Brady Manufacturing Company.
Brandel, C. O., Warren Electric & Specialty Company.
Brixey, W. R., Kerite Insulated Wire & Cable Company.
Brooks, J. W., Pass & Seymour.
Brophy, Capt. Wm., Edison Electric Illuminating Company.
Bryan, F. A., Indiana & Michigan Electric Company.
Bryant, Ernest R., Adams-Bagnall Electric Company.
Bryant, J. W., Wagner Electric Manufacturing Company.
Burleigh, Chas. B., General Electric Company.
Burnett, Douglass, Consolidated Gas, Electric Light & Power Company.
Burns, D. J., Ward-Leonard Electric Company.
Burt, B. T., Chattanooga & Tennessee River Power Company.

Callahan, Errett L., H. M. Byllesby & Company.
Campbell, Alex. J., New London Gas & Electric Company.
Campbell, Duncan T., Scranton Electric Company.
Candee, Willard L., Okonite Company.
Carrier, A. E., National Carbon Company.
Clark, E. L., Valentine-Clark Company.
Clark, R. W., Minneapolis General Electric Company.
Cleary, F. X., Western Electric Company.
Coale, Wm., Sterling Electric Manufacturing Company.
Cockey, Marston, R., Jno. A. Roebling's Sons Company.
Codman, John S., Holophane Company.
Coffin, C. A., General Electric Company.
Collette, H. S., J. G. White & Company.
Collier, Wm. Rawson, Georgia Railway & Electric Company.
Conklin, L. H., Helena Light & Railway Company.
Conklin, L. H., People's Light Company.
Corey, R. B., American Circular Loom Company.
Cortelyou, Hon. Geo. B., Consolidated Gas Company.
Cotabish, N. C., National Carbon Company.
Creed, Eugene, Morris Iron Company.
Crider, J. S., National Carbon Company.
Crouse, J. Robert, National Electric Lamp Association.
Cudmore, H. H., Brilliant Electric Company.
Cummings, C. A., Federal Sign System.
Cunningham, J. T., Allis-Chalmers Company.

Dale, John H., Dale Company.
Delafield, Clarence E., Crocker-Wheeler Company.
Dibble, Samuel F., General Electric Company.
Dion, A. A., Ottawa Electric Company.
Dixon, Jos. F., Allis-Chalmers Company.
Doane, S. E., National Electric Lamp Association.
Dodd, Philip S., National Electric Lamp Association.
Donkin, Wm. A., Allegheny County Light Company.
Donohue, Francis E., American Electrical Works.
Dostal, J. F., Denver Gas & Electric Company.
Doty, Paul, St. Paul Gas Light Company.
Doubrava, H. W., Wagner Electric Manufacturing Company.
DuBosch, C. A., Hugo Reisinger.

Eckert, W. S., National Conduit & Cable Company.
Edison, Thomas A., Edison Laboratory.
Eglin, Wm. C. L., Philadelphia Electric Company.
Eisenmenger, H. E., National Electric Lamp Association.
Eshleman, C. L., Adams-Bagnall Electric Company.
Evans, Wm. A. D., Cooper-Hewitt Company.

Ferguson, Louis A., Commonwealth Edison Company.
Frantz, H. M., H. W. Johns-Manville Company.
Fruenuff, Frank W., Denver Gas & Electric Company.

Gale, Frank H., General Electric Company.
Gardner, B. H., Dayton Lighting Company.
Garratt, Allan V., Lombard Governor Company.
Gear, H. B., Commonwealth Edison Company.
Gibbs, L. D., Edison Electric Illuminating Company.
Gilchrist, James M., Federal Sign System.
Gilchrist, John F., Commonwealth Edison Company.
Gille, Henry J., Minneapolis General Electric Company.
Godinez, F. Laurent.
Golding, F. H., Rockford Electric Company.
Goldschmidt, E. W., Wagner Electric Manufacturing Company.

Hadaway, W. S., Cutler-Hammer Manufacturing Company.
Harries, Geo. H., Potomac Electric Power Company.
Harris, Henry, United Electric Light Company.
Harris, J. D., People's Light, Heat Company.
Haughton, E. H., Bryan-Marsh Company.
Hegarty, D. A., Little Rock Railway & Electric Company.
Henderson, J. C., Waverley Company.
Henderson, O. B., Baker Motor Vehicle Company.
Henderson, Viles A., Merchants Power Company.
Henninger, J. G., National Electric Lamp Association.
Herman, J. L., Fort Wayne Electric Works.
Hill, Charles B., Cooper-Hewitt Electric Company.
Hill, H. P., Triumph Electric Company.
Hine, Henry, Central Mexico Light & Power Company.
Hodge, W. H., H. M. Byllesby & Company.
Hodskinson, Chas. H., Edison Electric Illuminating Company.
Holland, Henry F., Simplex Electric Company.
Hoppe, Oscar, American Circular Loom Company.
Houck, H. C., General Electric Company.
Howlett, C. A. S., General Electric Company.
Hughes, Geo. A., Hughes Electric Company.
Hughes, T. E., Standard Underground Cable Company.
Huntley, Charles R., Buffalo General Electric Company.
Huntley, Wm. R., Buffalo General Electric Company.
Hutchings, C. F., Sprague Electric Company.
Hutchings, James T., Rochester Railway & Light Company.
Hyde, Edward P., National Electric Lamp Association.

Ingalls, Percy, Public Service Electric Co.
Insull, Samuel, Commonwealth Edison Company.

Katzenstein, G. B., Cutler-Hammer Manufacturing Company.
Kirschner, E., Standard Underground Cable Company.
Kodjbanoff, B. G., Benjamin Electric Manufacturing Company.
Kulas, E. J., Tungstolier Company.

Lansingh, V. R., Holophane Company.
Layman, W. A., Wagner Electric Manufacturing Company.
Lieb, J. W., Jr., New York Edison Company.
Lillibridge, Ray D., Wagner Electric Manufacturing Company.
Lincoln, P. M., Westinghouse Electric & Manufacturing Company.
Lisle, Arthur B., Narragansett Electric Lighting Company.
Lloyd, E. W., Commonwealth Edison Company.
Lloyd, R. L., Philadelphia Electric Company.
Lloyd, R. McA., General Vehicle Company.
Lobenthal, L., Economical Electric Lamp Company.
Lobenthal, M., Economical Electric Lamp Company.
Lockwood, G. G., Bryan Marsh Company.
Lozier, Robert T., Kountze Bros.
Lupke, Paul, Public Service Electric Company.

McCall, Jos. B., Philadelphia Electric Company.
McConnaughy, H. G., Dearborn Drug & Chemical Works.
McQuiston, J. C., Westinghouse Electric & Manufacturing Company.
Macbeth, Norman, Westinghouse Lamp Company.
Mace, Romaine, Okonite Company.
Marsh, Charles J., Standard Underground Cable Company.
Martin, Lewis G., Okonite Company.
Merrill, G. S., National Electric Lamp Association.
Miller, W. M. S., Allis-Chalmers Company.
Montague, Joseph E., Buffalo & Niagara Falls Electric Light & Power Company.
Murray, Thomas E., New York Edison Company.

Nash, Cyril, New York Edison Company.
Neumuller, Walter, New York Edison Company.
Niesz, Homer E., Cosmopolitan Electric Company.
Norris, N. L., Banner Electric Company.

Orr, R. S., Allegheny County Light Company.

Page, A. D., General Electric Company.
Pardee, E. T., Allis-Chalmers Company.
Park, F. C., National Carbon Company.
Pike, E. D., Wagner Electric Manufacturing Company.
Pinckard, W. R., Westinghouse Electric & Manufacturing Company.
Purdy, C. J., American Electric Lamp Company.

Reisinger, Hugo.
Replogle, Mark A., Lombard Governor Company.
Rice, Harry C., General Incandescent Lamp Company.
Rockefellow, E. B., Western Electric Company.
Rypinski, M. C., Westinghouse Electric & Manufacturing Company.

Satterlee, R. S., Habirshaw Wire Company.
Sawyer, L. P., Buckeye Electric Company.
Schuchardt, R. F., Commonwealth Edison Company.
Scott, Chas. F., Westinghouse Electric & Manufacturing Company.
Scribner, J., General Electric Company.
Seelman, M. S., Junior, Edison Electric Illuminating Company.
Sines, H. S., Minerallac Electric Company.
Sisson, Willard S., D & W Fuse Company.
Stannard, Clare N., Denver Gas & Electric Company.
Steele, H. B., Century Electric Company.
Steele, H. G., Pittsburg Transformer Company.
Sweet, Arthur J., Holophane Company.

Tait, Frank M., Dayton Lighting Company.
Terry, F. S., National Electric Lamp Company.
Tripp, Geo. B., Colorado Springs Light, Heat & Power Company.

Vail, J. H., General Vehicle Company.
Van Ness, Leonard G., Merchants' Power Company.
Vanzwoll, H. M., National Electric Lamp Company.

Wagoner, P. D., General Vehicle Company.
Wall, Benjamin, Wall-Win Company.
Whaling, T. G., Westinghouse Lamp Company.
Wiley, G. L., Standard Underground Cable Company.
Willcox, F. W., General Electric Company.
Williams, Arthur, New York Edison Company.
Winship, W. E., Gould Storage Battery Company.
Wolcott, F. E., Franklin Electric Manufacturing Company.

Young, H. W., Sangamo Electric Company.
Young, Lorin W., Macbeth-Evans Glass Company.

Chicago Elevated Railroad Merger.

The proposed merging of the four elevated railroad systems in Chicago, that was referred to in these columns several weeks ago, has been approved by the boards of directors of the respective companies and is now being submitted for approval by the stockholders. If a very large percentage of the latter deposit their shares in a reasonable time the negotiations will be finally concluded. The Chicago Elevated Railroad Company is the title proposed for the new consolidated corporation.

Rapidly Increasing Use of Electric Power in Leeds, England.

The use of electricity for power purposes is increasing very rapidly in Leeds, England. In 1898, when the city acquired the electric plant, there was not to exceed twenty horsepower of motors connected to the mains; now there are approximately 1,200 users, with not less than 14,000 horsepower in use. A material reduction of price per kilowatt-hour will become effective July 1. The reduction to small users is from three and one-half to three cents per unit. Further concessions, based upon quantity used, are given to users of 3,000 kilowatt-hours and upward in a quarter. The price descends by stages to a minimum of one and one-half cents per unit, less five per cent for cash. The latter price will be charged to consumers of 400,000 units and upward per quarter and is an inclusive figure covering the cost of converting the energy to proper voltage.

Electrical Notes From Great Britain.

By Our British Correspondent.

The conduit tramway service of London has, during the past year, cost roughly $24,000 for the removal of sludge from the conduits. One of the disadvantages of this costly, but otherwise excellent, service of tram cars was mentioned in the courts when the London County Council was held to be responsible for a collision which occurred between an automobile and one of its tramcars when the latter stood upon the dead points and could not be seen because its lamps were not lighted. That the Council is authorized by its Acts to have "dead" points does not therefore excuse it for not having a system of lights independent of the general tramway supply.

The subjects announced for the meeting of the Municipal Electrical Association at Brighton and Portsmouth from June 27 to 30 are these: "Electricity Supply from the Municipal Committee's Standpoint," by Councillor H. Leese; "Modern Wiring Practice," by J. W. Beauchamp; "Internal-Combustion Engines in Power Stations," by H. L. Howard and R. M. Carr; "Purchase of Fuel" (discussion); "Street and Shop-Front Lighting" (discussion).

The Managers' Section of the Municipal Tramways Association at a two days' meeting (May 18 and 19) at Leicester has been considering among other subjects the lubrication of car bearings, the ventilation of tramway motors, merit and bonus systems for motormen and conductors, and lamps for traction purposes.

The National Electrical Manufacturers' Association has issued a special set of rules embodying the conditions upon which its members have agreed relating to the sending out of arc lamps on approval, and regarding the letting out of arc lamps on hire or hire purchase. Such points as the charge to be made, the use of the apparatus, conditions as to packing, insurance, etc., are all covered. The reason for these rules is that so far there has been a great diversity in practice and uniformity is desirable.

The Worcester Municipal Corporation is going to change over its electric supply system from single-phase to three-phase alternating current. Edinburgh, which has been pretty sound in the past in its electricity finance, has been discussing what to do with last year's profits on the light and power department. It was hoped that an original proposition that this sum of $36,000 be devoted to reducing the capital debt would have been approved, as this is the course that is being advocated in a number of other plants, in the interest of sound finance. The proposition has, however, been defeated by an amendment which voted the sum mentioned for the relief of the immediate taxpayers. The Marylebone municipal electricity department estimates that with a sale of nearly 12,000,000 units during the current year, it will only have a surplus (after meeting financial charges) of about $5,000. The reason assigned is that a new assessment of the undertaking for rates and taxes will add an extra expenditure under this head of about $43,000 per annum. The sales, wiring and publicity department of the Marylebone installation has been continuously criticised by contractors who resent municipal competition with themselves as taxpayers. The department is trying to make it plain that it exists for the sale of current, not to make profit on sales of apparatus or the carrying out of installation work. The contractors naturally feel that if such work is conducted at a loss they are subjected to unfair competition. The West Ham Corporation will have to spend $300,000 on extensions to its electricity works, $70,000 for turbo-alternator, $62,000 for boiler plant, $42,000 on river-service pipe work, and the remainder for mains, coaling-plant, buildings, etc. A 5,000-kilowatt turbine set is specified by the engineer, and by its installation an economy of fifteen per cent will be made as compared with any of the plant already installed. In regard to the coaling plant, it is proposed to install a telpher scheme beside the existing runway of the Temperley transporter, and it will handle sixty tons per hour. Certain parts of the engineer's proposal must be carried out speedily if the undertaking is to be enabled to cope with next winter's demand. West Ham is making admirable progress in the supply of power to works and factories, which are numerous in the district.

The Shoreditch (London) Electricity Committee also is experiencing a big demand for both power and light and, in addition to taking bulk supply from one of the tube-railway power stations, it must add to its present generating station or make further bulk supply arrangements.

The report of the Leeds Electricity Department shows that the adverse effect of the metallic filament lamp is "drawing to a close if it has not entirely terminated." For the first time since 1908 the decrease in lighting sales is more than counterbalanced by the sale of energy for power and heating, the total revenue being $27,000 larger than in the previous year. Units sold were nearly 14,500,000, a considerably larger number than ever before, but the revenue is still about $45,000 less than in 1908, the highest previous year. One event of the year is the scrapping of a 300-kilowatt engine and alternator "because they are now too small to be economical."

The Coventry Electricity Department also draws atention to the fact that it has been finding it beneficial to scrap equipment as soon as it was found to be superseded by more modern types.

Several more of the railless trolley schemes have been either dropped, or defeated in the parliamentary Committee stage, during the last few weeks. Local authorities are opposing the threatened advent of private companies operating such systems in their districts, the effect upon roadways, the proposal to have a driver in sole charge of the cars and no fare collector, the want of experience with the system and the uncertainty of it being profitable in the districts concerned, being all among the grounds for opposition.

At Newcastle-on-Tyne the powers have been refused because the Corporation proposed running the cars outside its own area. In the case of Aberdare permission has only been granted for the running of railless trolley cars on condition that the Council agrees to pay one-third of the cost of repairing the roads used by the vehicles. This condition was imposed as the result of

representations by the Glamorgan County Council.

The purchase of the telephone system by the State has been occupying the attention of the Law Courts at a number of sittings, a preliminary action having been taken to secure a definite ruling as to the power of the Postmaster-General to refuse to take over from the National Telephone Company certain parts of the undertaking of the latter because he or his advisers hold it to be unsuitable for his purposes when the State operates the entire service. The Postmaster-General does not limit his argument to actual unsuitability by reason of inefficiency or obsolescence, but seeks to show that what is unnecessary because of other equipments in his possession, is unsuitable under the meaning of the agreement adopted by the parties when the purchase was resolved upon. Technical evidence has been given, and some of the London exchanges have been visited by the judges, whose decision stands reserved at present. The proposal that a Telephone Authority be appointed to control the entire telephonic service of the United Kingdom instead of the Post Office being responsible, has continued to receive attention in business circles, but from utterances of the Postmaster General it does not appear that there is any likelihood of the idea finding favor with the Government. The Post Office has just announced proposed increased telephonic facilities for farmers in country districts.

The Iron and Steel Institute has held its two days' meeting in London under the presidency of the Duke of Devonshire. One of the opening incidents was the presentation of the Bessemer gold medal for 1911 to Professor Henry C. Chatelier, in recognition of his services in connection with metallurgical science, the president making special reference to his thermo-electric couple which is everywhere used in pyrometrical experiments. A number of papers of indirect electrical interest were read and briefly discussed. The autumn meeting is to be held at Turin.

The British Westinghouse Electric & Manufacturing Company has held its annual meeting in May, and though the improvement in the business was reflected in an increase of the trading profit from $420,680 to $562,700, it is stated by J. Annan Bryce, the chairman, that the concern cannot reach a dividend-paying stage until the capital has been written down, and that proposals for such writing down cannot be put forward until the directors know the result of their appeal against the Lots Road arbitration award. If the appeal goes against them, this item will mean, including the costs, about $600,000. No secret is made of the knowledge that the works at Trafford Park were designed originally on far too lavish a scale, Mr. Bryce says he doubts whether under the most favorable circumstances it would have been possible to occupy, not the floor space, but the cubic space of the works in the way designed. The average number of men employed has been 5,000.

ALBERT H. BRIDGE.

London, May 25, 1911.

Automatic Telephony.

In an address before the Chicago Electric Club, on June 7, treating of the history, development and advantages of automatic telephony, W. Lee Campbell, superintendent of the Automatic Electric Company, spoke of the adverse circumstances that had to be overcome for a period of practically twenty-five years before the advantages of the automatic telephone were publicly acknowledged.

The first patents on the automatic system were granted in 1878, but it was fully twenty-five years before commercial applications were made of it on a large scale. Mr. Campbell said that the persistent belief in the automatic, by its sponsors, during this long period is one of the impressive features in the history of automatic telephony.

One of the incidents which was of great benefit to the development of this system of voice transmission was the act of Joseph Harris, who in 1892 induced the manufacturers to conduct an exhibit during the (Chicago) World's Fair.

The first automatic exchange was installed in Laporte, Ind., shortly thereafter. Five wires were necessary between each instrument and the exchange in this installation, each wire connecting a signal button, five push buttons being necessary to make a connection. In 1895 an installation was made in Michigan City, Ind., in which only two wires were necessary. Magneto signals and local batteries for the talking circuits were employed.

The calling device now used on automatic telephones was brought out in 1896, and in 1903 several large exchanges, notably in Dayton, Ohio, Grand Rapids, Mich., and Chicago, Ill., were installed, having a total of 20,000 lines.

An idea of the hardships imposed on the Automatic Company is shown in the contract made for the Grand Rapids installation, which, Mr. Campbell stated, called for a guarantee of the entire equipment for seven years, and if the equipment was not satisfactory to ninety per cent of the subscribers at the expiration of the contract the whole to be taken out. Mr. Campbell said the contract expired last January and less than $1,000 was spent in repairs.

The first common-battery exchange was placed in operation at South Bend, Ind., in 1895, and shortly thereafter a system was installed in Pontiac, Ill. Prior to the latter installation ground connections were made at the subscribers' stations, but this was done away with at the latter installation.

Mr. Campbell then hastily reviewed the development of the automatic telephone up to the present time. There are now 350,000 automatic telephones in use, the largest installation being in Los Angeles, Cal. European countries are also introducing the automatic, telephones being manufactured in France by the French Thomson-Houston Company and in Germany by Siemens & Halske. A number of the advantages of the automatic telephone were then given by the speaker.

Questions were asked by Messrs. Jackson, Mabbs and Connelly. Mr. Campbell, in reply, spoke of private-branch exchanges and also described briefly the loud-speaking telephone.

Power on the Hamilton River.

It is estimated that the Hamilton River, in Northern Quebec, presents an available power exceeding that of Niagara Falls. This estimate places it at 9,000,000 horsepower. At present there is no market for power in the neighborhood, but at some future date a great development may be expected.

Swedish Hydroelectric Developments.

There are under construction in Sweden at least eight hydroelectric power developments that will aggregate about 115,000 horsepower. Of these the plant at Porjus being erected by the Swedish Government will alone develop 50,000 horsepower.

Electrical Notes from Continental Europe.

By Our Paris Correspondent.

A new section of the Paris subway is now under construction and it runs from the place de l' Opera to the outlying Auteuil quarter. Where it crosses the Seine there is being carried out a considerable piece of engineering work in the shape of an iron-tube tunnel which passes under the river. It is different from any of the foregoing work of this kind in the Seine from the fact that a double-track tube is used. It will be remembered that the iron-tube construction was already employed for one of the subway sections, but in this case two tubes of small diameter for single track were laid. The new Opera-Auteuil section is the first instance in France of the use of a large-section tube carrying double track. This work is being carried on at present by the Daydé-Pillé construction firm. The tube is of 7.2 meters inside diameter and runs for 618 meters between two underground stations on each side of the Seine. One of the stations lies under the Place de la Concorde. A shield resembling those of the Jacobs system, which was used in America under the Hudson, was adopted here, and it is driven forward by hydraulic jacks.

A temporary plant of some size is erected near the river, and it contains a number of electric motors belted to air compressors and water pumps for carrying out the tunnel work. Current is taken from the city mains and comes from two separate plants in the suburbs, so that there will be no stoppage. The mains run on 5,500 volts, three-phase, and this current is used directly on the motors, which run the four main air compressors. Each of these is belted to a three-phase induction motor of 220 horsepower. The above compressors furnish air at low pressure. For the high-pressure supply there is mounted a fifth group, and it is driven together with two water pumps from a common countershaft belted in turn to two 100-horsepower three-phase motors. A bank of transformers furnishes the current for these two motors at 200 volts, as well as for the other uses of the plant.

The first instance of the use of loud-speaking telephones for a city fire alarm system appears to be at Kiel, Germany. The apparatus is mounted at various places in the streets of the suburban district, and is contained in a solid iron box which can be easily opened. When the box is opened, a contact is made automatically which rings up the fire department station. Owing to the use of the loud-speaking telephone it is easy to call the station, even when there is much noise in the streets, and the voice is very clearly heard.

One of the most recent hydraulic plants is the Albula station, which works over a power line to the city of Zurich. It is laid out for eight main turbine groups of 3,000-horsepower size, operating upon a 150-meter head of water. The machines are three-phase alternators and deliver 7,000 volts at fifty cycles. Each of the alternators works together with a transformer of like capacity so as to raise the voltage for the power line to 50,000 volts. The transformers are of the water-cooled oil type. Two separate power lines are run along in parallel and these are mounted on reinforced concrete poles for the most part. Mannessmann iron-tube poles are also used to some extent, as well as structural iron towers where they are needed. At Zurich the power lines are received in a large substation where the voltage is lowered to 6,000 volts for the city lighting mains. The plant contains three motor-generator sets of 1,500-kilowatt size for the lighting mains. Direct current is also furnished for the tramway lines by three rotary groups which work with a storage battery in parallel. Provision is made for operating the 6,000-volt three-phase sets should the power-line current fail. They can be driven by direct-current machines mounted on their shafts, using a separate storage battery for the purpose. A supply of current is thus given until the steam-engine groups of the plant can be started up.

Experiments are being made in Germany as to the best method of working with electric motors in mines where fire-damp occurs. The Westphalian Mining Company has been testing a number of specially-built motors for this purpose. It is generally recognized that it is impossible to prevent gases from penetrating into the motor. To avoid explosions in the mines there are two methods which can be used. In one case the motor is of extra strong ironclad form and very tightly enclosed so that even should an explosion of gas occur inside the motor it will not damage it nor will the effect reach the outside. A second method is to provide the motor with openings and to cover these with wire gauze after the manner of a safety lamp, using 0.02-inch mesh. Tests are being made of both these kinds of motor by producing explosions inside them for a number of times and observing the result.

The new Bellini-Tosi directed-wave system for wireless work is likely to prove valuable on shipboard. Experiments are being made with apparatus of this kind on the "Provence," one of the vessels of the Compagnie Transatlantique. It will be remembered that two aerials crossed at right angles are used, together with a set of revolving induction coils mounted so that the strength of the waves in each aerial can be varied. The result is that such a crossed aerial can be made to send out waves towards any desired point of the horizon. Quite recently it was found that four crossed aerials were an improvement over two aerials, and this allowed of shortening up on the horizontal wire leading to the instruments. This is of great advantage on shipboard. The instrument for directing the waves, known as radio-goniometer, has been modified to correspond and is constructed at the Ducretet establishment in Paris. It contains eight fixed coils and an inner rotating coil, so that by turning this about a graduated circle the waves can be directed to any point. The ship can find its position with reference to shore posts by using the present instruments and this will be of great advantage during fogs.

The East Sicily Electric Company already owns two hydraulic plants of some size which feed a power network, and it expects to extend its operations very shortly and to erect a number of other plants in various parts of the island. One of the existing stations lies upon the Alcantara River, which flows around the base of the Etna. A 108-meter head of water is secured

from the stream. The water is taken by a four-kilometer flume to a large storage basin by which the output of the plant is much increased. In the station there are mounted three 2,500-horsepower turbine sets using Escher-Wyss Swiss turbines coupled to Thomson-Houston alternators. Transformers raise the voltage to 40,000 volts for the power network. The second hydraulic plant located on the Cassibile River is designed to run on the same network and also furnishes 40,000-volt current. It also supplies a separate power line at 5,300 volts. This station lies in the Syracuse province and has a 275-meter fall, using a storage basin at the end of an eight-kilometer flume. The machine plant is situated seventeen kilometers from Syracuse and is built of reinforced concrete so as to provide against earthquakes which prevail in this region. Four Escher-Wyss turbines of 2,000-horsepower size are coupled to Brown-Boveri alternators. These machines deliver 5,250 volts and the voltage is put directly upon a local power line. The voltage is also raised to 40,000 volts so as to work in parallel with the Alcantara station upon the power network, and this later now runs to Syracuse, Messina, Ragusa and other cities of Sicily.

The French Government has made an agreement with the different Marconi companies which will be of great benefit to wireless work upon vessels. Up to the present the Marconi companies did not allow vessels equipped with their apparatus to communicate on the high seas with ships provided with other systems. The Telegraph Department now obtains a concession in this respect, and from now on it will be possible for all vessels to signal to each other, regardless of what apparatus they carry. This is an important point now that the use of wireless apparatus on shipboard is greatly increasing.

The time of travel by rail between Milan and Munich is to be shortened considerably by a new electric railroad which will run partly in Italy and partly in Switzerland and Austria. On the Italian side it starts from Tirano, which is the terminal station of the Valtellina standard-gauge electric line, and reaches Bornio, at the foot of the Stelvio mountain. From this point a tunnel of nine kilometers length runs through the mountain and ends on the other side of the Swiss frontier at Valcava. The line runs for a short distance on Swiss territory and crosses into Austria to the town of Mals. The project will be continued to Handeck by a line which the Austrian Government will construct. From Landeck passengers will reach Munich by the existing railroad. However, it is likely that a special line will be built conjointly by the Austrian and Bavarian railroad departments which will connect Landeck directly with Munich.

Among the new incandescent lamps we note the new Iota metallic filament lamp which is made by the German Regina firm. It uses the Hoppelt process, taking a tungsten filament as a base and covering it with a layer of carbon. This is said to give a hard and elastic filament which has many good points, and it is also economical. Some of the lamps were put through a test at the Cologne city station, and nine thirty-two-candlepower lamps were run on fifty-cycle 110-volt circuits, showing 1.04 watts per candlepower at the start, 1.08 watts after 800 hours, and 1.13 watts at 2,000 hours. The life is from 900 to 1,500 hours for lamps placed horizontally, and 1,800 to 2,000 hours for lamps burning in a vertical position.

The Paris-Lyons-Mediterranean Railroad Company is commencing to run electric trains on the section lying between Cannes and Grasse in the Mediterranean coast region. A new type of electric locomotive designed by M. Auvert, one of the company's engineers, is used on the line.

Diesel oil engines are coming into use for central stations in Europe, and have proved very satisfactory. M. Thonet recently gave some data upon nine tramway stations which used the oil engines exclusively, and these comprise a total of thirteen Diesel engines ranging from 160 to 400 horsepower and constructed by the Sulzer firm of Switzerland, the Augsburg-Nuremberg Company, the Carels firm of Ghent and others. The two or three-cylinder type is generally used, and more rarely the four-cylinder engine. As to oil consumption, data were given as to the mean annual consumption per kilowatt-hour. The average for the nine plants is 315 grams of crude petroleum per horsepower-hour. One of the engines was put through a good series of tests, this being a Nuremberg motor of 300 horsepower installed in the Sebastopol tramway station in Russia. This is a vertical three-cylinder engine coupled direct to a 200-kilowatt generator giving 760 amperes at 500 volts. The crude oil came from the Baku region and cost 1.5 cents per litre. The lubricating oil figures at 14 cents per kilogram. On the test the following figures may be noted. Full load, 5.5 hours run, 206 kilowatts; 162.5 revolutions per minute. Oil consumption, fuel, 63.1 kilograms per hour, making 307 grams per kilowatt-hour. Lubricating oil, 33 grams per kilowatt-hour. Half load, five hours run, 103.5 kilowatts; 164.5 revolutions per minute. Oil used, 407 grams per kilowatt-hour. Lubricating oil, 50 grams per kilowatt-hour.

At the Turin exposition a somewhat unusual method of arc lighting will be used. As the grounds extend for some length on each bank of the River Po, it was decided to run a great number of arcs in series so as to economize on the wiring. This could be done by using the new Conto ten-ampere arc lamps, made at Cologne, and 130 lamps are run in series on the 6,300-volt three-phase mains. Compared with using four arcs in series on 220-volt circuits, we have twenty-nine tons of copper for the wiring in this case, while using 130 lamps on 6,300 volts requires but 1.8 tons. Hence the advantage will be seen.

The municipality of Turin is now taking measures to light some of the principal avenues on this occasion, and is to use sixty-five arcs with metal electrodes on the new Westinghouse system. The carbon will be replaced by a special electrode of metal which is claimed to burn for 150 hours and gives 1,400 candlepower on sixty-eight volts and 6.6 amperes. As the city mains run on 6,300 volts three-phase, a transformer will be used in connection with a rectifier of the Cooper-Hewitt type.

The new hydraulic plant which will be erected in the Tyrol will rank among the large European stations. It will be located on the Flaror River between Buntscheu and Chateau-Ried and is to have an output of 30,000 horsepower. Current will be used for operating a number of electric railroads which the Austrian Government is to build in this region in the near future.

A. DE COURCEY.

Paris, May 24, 1911.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

SPRING MEETING AT PITTSBURG.

A most comprehensive program was laid out for the Pittsburg meeting of the American Society of Mechanical Engineers, which opened May 30. Not only were the professional papers of wide scope and great interest, but advantage was taken of the wonderful possibilities of the Pittsburg district to furnish entertainment to a body of visiting engineers. As far as possible the various trips laid out for the Society served to illustrate some of the processes discussed in the papers presented at one session or another of the meeting.

Tuesday, May 30, was given over to informal receptions, and to visits to the exhibit of foundry machinery in Exposition Hall. In the evening, Col. E. D. Meier, president of the society, was presented with a testimonial from the Society, together with a handsome microscope, the day being his seventieth birthday.

THE CEMENT INDUSTRY.

Professional sessions began Wednesday morning in Carnegie Institute. The Society has recently adopted a policy of broadening its scope so as to include all industries with which the mechanical engineer may be connected in any capacity whatever, and proposes to hold symposiums on these different industries at its various meetings. The Pittsburg meeting marked the first step in the carrying out of this policy, and the cement industry was selected as the subject of discussion. Three papers on this subject were prepared and presented together, after which the discussion was made general on the question of cement manufacture.

The titles and authors of the papers were as follows: "Some Problems of the Cement Industry," by Walter S. Landis, associate professor of metallurgy at Lehigh University; "The Edison Roll Crusher," by W. H. Mason, of the Edison Portland Cement Company; "Power and Heat Distribution in Cement Mills," by L. L. Griffiths, of Cement, Tex.

PROBLEMS OF CEMENT INDUSTRY.

Professor Landis made the point that the greatest problem in the cement industry is the development of plant rather than the development of process, the chief features in this development being the determination of the best size of first crushing units, the fineness of grinding of raw materials before entering the kiln, the gradual displacement of the wet process by the dry, better utilization of the fuel in clinkering and the abandonment of the air separator. With the decrease in profits in the industry the improvement of the older plans is impertive. This paper was illustrated with lantern slides which gave a general idea of the plant and process of cement manufacture.

EDISON ROLL CRUSHER.

It was brought out that the gyratory crushers in ordinary use had insufficient capacity to handle stones larger than forty-two-inch cube. Mr. Edison, realizing that coal was cheaper than dynamite, calculated that a vast saving could be effected by utilizing the energy contained in coal to break up the stones brought from the quarry, by means of giant crushers which would handle a seven-foot cube, rather than by expending large quantities of explosive to break the quarried rocks to sizes which would enter the gyratory crusher. The paper details the experiments carried on to attain this end and gives records from tests extending over two years, which show a great economy over the former methods of crushing.

POWER AND HEAT IN CEMENT MILLS.

In his paper, Mr. Griffiths compared the methods and results of five different cement plants for converting the energy of fuel into work. The data given enable comparisons to be made between the same types of machinery.

In the discussion which followed the reading of these papers, the following points were brought up: the suppression of dust from the kilns, and the losses due to the escape of dust; the relative merits of the wet and dry processes; the advantages of mechanical drive as compared to electrice drive; the utilization of waste heat; the utilization of cement made from blast-furnace slag. Considerable difference of opinion developed between the advocates of wet and dry processes, the chief point at issue being the length of time that elapsed before the moisture introduced in the wet process was driven off in the kilns.

In regard to mechanical versus electrical driving of cement-mill machinery, one speaker maintained that the mechanical drive gave a better all-around efficiency as compared to the electrical drive. He was opposed by another speaker on this point, who, while ready to grant for the sake of argument that the mechanical drive might be more efficient, stated that other considerations than efficiency were important. The freedom from the necessity of shutting down the entire plant on account of the breakdown of one part was an advantage of the electric drive which could not be overlooked. Clutches and other devices which of necessity were accompaniments of the mechanical drive, were clumsy and difficult of operation at critical times.

The use of blast-furnace slag cement was stated to approximate fifteen per cent of the entire output of the country at the present time, and it is steadily growing. It was held to be fully equal to Portland cement made from natural rock. To illustrate the manufacture of this type of cement, a trip had been arranged to the plant of the Universal Portland Cement Company, at Universal, Pa., and in the afternoon a special train of nine Pullman cars conveyed members and guests to these works. Returning, the party stopped at East Pittsburg to inspect the shops of the Westinghouse Electric & Manufacturing Company.

MACHINE-SHOP PRACTICE.

Simultaneous sessions were held on Wednesday evening, one being a meeting of the Gas-Power Section, and the other a session devoted to machine-shop practice. At the latter session, three papers on somewhat related subjects were read and discussed together. These were: "The Assembly of Small Interchangeable Parts," by John Calder, of the Remington Typewriter Company, Ilion, N. Y.; "Quantity Manufacture of Small Devices," by T. P. Cox, of the meter department of the General Electric Company, Lynn, Mass.; "The Process of Assembling a Small and Intricate Machine," by Halcom Ellis, general manager of the Ellis Adding Typewriter Company, Newark, N. J. The first paper described the application of time-study and task methods of Taylor and Gantt to the problem of assembling the various parts of the Remington typewriter, and showed not only how the output had been increased, but the accuracy and cost of the machine had been favorably affected by these methods. Mr. Ellis's paper described the elaborate system necessary to assemble the Ellis adding-typewriter, an intricate machine of 3,400 pieces.

QUANTITY MANUFACTURE OF SMALL DEVICES.

Mr. Cox's paper considered the manufacture of small but not complicated apparatus, the assumption being made that the apparatus is properly designed for economical manufacture. The principal ideas brought out by the author are: Changes in design, except at stated periods, should be provided; responsibilities of the different assistants should be sharply defined and should not overlap; stock handling is of the greatest importance in order to avoid interference with the labor cost; and the chief function of an organization is to assist the workman to perform a maximum of work with a minimum of effort.

In the discussion of these papers, the methods of assembling small telephone

parts were described, the system used by the Western Electric Company being used for illustration. Raw materials and tools are inspected by the production department, which is in absolute control in the shop so far as getting the product through is concerned. The testing, rate setting and methods departments attend to their own functions and do not interfere with work in progress through the shop. Reaming, tapping and blending operations are all carried out in the assembling department, where the use of a file is absolutely prohibited.

The only other paper of the session was by A. L. de Leeuw, and was entitled "Milling Cutters and Their Efficiency."

In this paper a new form of milling cutter of high efficiency, formed by increasing the tooth spacing and depth, is described. These consume less power and do a greater amount of work at one sharpening than the ordinary cutter. A change in the form of chip breakers enables these to be used for finishing as well as for roughing work. The paper also described a new style of face mill known as a helical mill. Attention was called by the author to the possibilities which lie in a more scientific construction of milling cutters, and to the advisability of discarding present-day ideas on this subject, they being based on conditions which are now largely non-existent.

The discussion which ensued developed wide differences of opinion, a certain set of speakers agreeing with the conclusions of the author, while others flatly denied the correctness and value of his studies.

GAS POWER.

Simultaneously with the machine shop session, the Gas Power Section of the Society, held a meeting in the Carnegie Technical Schools. A report was presented by the Installation Committee covering the records collected by it of the recent installations of gas-power equipment. Following, there was a discussion on large gas-power plants participated in largely by those in charge of such installations. The large number of plants in the Pittsburg district, which were thrown open to inspection by the members, lent considerable interest to this discussion, which was opened by E. A. Macoun, superintendent of the blast furnaces of the Edgar Thomson Steel Works. Mr. Macoun called attention to the card characteristics of the four-cycle gas engine, pointing out particularly the high initial pressure of 300 pounds per square inch or more, and the low mean effective pressure of about 65 pounds. If a new cycle for slow combustion can be developed, gas engines need not be designed for such high maximum pressures in proportion to comparatively low mean effective pressures. At the Edgar Thomson furnaces one blowing engine, gas-driven, has operated 93 per cent of the time for an entire year, another for 90 per cent of the time, while a gas-driven electric generator has operated 85 per cent of the time.

The changes necessary to make engines operate satisfactorily were detailed by another speaker. To run economically, the engines must run almost continuously, and important economic factors, compared with steam engines, are first cost and operative cost. The problem of cylinder desgn has not yet been fully solved, as cylinders tend to crack and allow the leakage of water into the cylinder. They must be carefully water-jacketed to prevent unequal expansion. Steel castings, which permit thinner walls, are favored, and the cylinders should be made in halves and the lining bushed in, to permit of easy renewal. Cast steel should be used for pistons, which should be made in parts. The design which gives the greatest strength and allows the greatest expansion approaches a sphere in form. In order that there may be no pressure on the cylinder walls, except that due to the rings the pistons should float. Open-hearth steel is considered more satisfactory than nickel-steel for piston rods; cooling water for the rods should be introduced and taken out at the ends, as openings in the sides often form the starting points of cracks. The fiber rings used in connection with piston-rod packing should be made solid and sufficient in number to reduce the pressure before it reaches the main packing. A requirement of a successful inlet-valve gear is that a reasonable percentage of dirt should not cause excessive wear.

R. H. Stevens, of the Homestead Works of the Carnegies Steel Company, related the experience at those works with four blowing and five electric engines. There are six units in the gas-cleaning plant and an efficiency of over 99 per cent is obtaining in cleansing. The dust content of the cleaned gas is but 0.003 grain per cubic foot. The gas has a thermal value of 85 to 90 British thermal units per cubic foot. The engines are ready to run 95 to 98 per cent of the time, although they are required only for about 90 per cent.

A. N. Diehl, of the Duquesne Steel Works, compared the thermal values of fuels used in internal-combustion engines, ranging from 1,000 British thermal units for natural gas to 175 for producer gas, and 90 for blast-furnace gas. The last is ideal for gas-engine operation on account of the low rate of flame propagation, permitting high compression. The successful use of furnace gas depends largely on the efciency of the cleaning apparatus, and the best results were obtained at Duquesne by spraying in the scrubbers, which, by means of a special spraying device, prevented channeling of the gas in the scrubbers. The maximum efficiency obtained in the engines at Duquesne was 30.9 per cent. Electric engines, developing 3,300 kilowatts, gave 4,807 brake horsepower, and 5,641 indicated horsepower. In the last six months the engines have operated for an average of 98.8 per cent of the time.

The installation of gas engines at the McKeesport plant of the National Tube Company was next described. Certain changes were made in the engines, as follows: The piston water-cooling system had telescopic joints substituted for swinging joints; the spark plugs were given a rotary, instead of a reciprocative motion; the gearing on the lay shaft was changed from the spiral to the spur type; the connections between the exhaust valves and the mufflers were equipped with expansion joints. During 1910, engine No. 1 operated 79 per cent of the time, with an average load-factor of 81 per cent, and engine No. 2 operated 91 per cent of the time with an average load-factor of 79 per cent. In the speaker's opinion it was still possible in the Pittsburg district to obtain better results with steam engines than with gas engines.

H. J. Treyn could not reconcile the doubts that gas engines are as good as steam engines, and the statements of gas engines operating 95 to 98 per cent of the running time. At Gary, but one-quarter of one per cent was the total delay charged against the gas engines. Mr. Treyn pointed out that practically all the installations discussed were made some time ago and represented, in many cases, the first attempt of the builders. The principal need of American gas engines is better design. Better foundry practice abroad is responsible for fewer cracked cylinders, for which portion steel is unnecessary. A good cast-iron cylinder, properly made, is entirely suitable. Exception was taken to the figures recently circu-

lated in this country as to the cost of gas engines per kilowatt, they being entirely too high. While the cost of a gas-engine installation is greater than that of a steam engine or turbine, the difference is less than is commonly believed, and the saving in operating expense should more than offset it. American gas-cleaning plants were held to be superior to those abroad and the speaker cited an instance where he had opened an engine after a long period of operation and found it in splendid condition, with scarcely a handful of dust or carbon deposit in the cylinder. The prediction was made that the combination of gas engine and low-pressure steam turbine would give the most economical results. Another speaker argued that gas engines of larger capacity should be built. A fair figure for present gas engine cost is $125 per kilowatt. The speed of gas engines should be increased and they should be capable of operation by unskilled labor.

The prevention of mine accidents was discussed by C. D. Smith, who outlined the work of the Pittsburg station of the United States Bureau of Mines. Lantern slides gave an illustration of the methods employed.

MISCELLANEOUS SESSION.

Thursday morning was given over to a session at which miscellaneous papers were considered. Prof. R. T. Stewart, of the University of Pittsburg, read a paper entitled "Stresses in Tubes," which supplemented his former papers on the same subject and completed a most masterly research on a highly important subject. Prof. Stewart at this session presented to the Society a massive volume which contains his original data, for which he received the thanks of the Society.

Dwight T. Randall then read a paper, "The Purchase of Coal."

THE PURCHASE OF COAL.

Most boiler rooms are now conducted in a manner which permits of considerable saving along two lines: (a) the selection of a coal which is suited to the plant and at the same time is capable of delivering the greatest amount of heat to the boiler for a unit of cost; (b) burning the coal by approved methods to obtain the highest practical efficiency. The coals which are offered in almost any market vary in price and in quality to an extent which justifies a careful study of their character and heating value in order to determine which coal will prove must economical when the equipment, the load conditions and the price are considered. A coal which is entirely satisfactory in one plant may be unsuited to another. It is possible to burn almost any fuel with reasonably good efficiency provided the furnace is properly designed for the particular fuel to be burned. Coals which are suitable for any given equipment depend for their value principally upon their British thermal units and the size of the coal. A thorough study of coals and the variations in their quality has naturally led to the purchase of coal under specifications with a guaranteed analysis, which provide for a definite procedure in case of a variation in the quality of coal delivered.

In the discussion, the importance was pointed out of designing power plants to burn low-grade fuel, which would otherwise go to waste. The use of steam blowers in this connection was touched upon. It was held that coal producers should be made to assume greater responsibility for the quality of the fuel offered to purchasers, and the proximate analysis should not be made the sole basis for judging the quality of fuel. Other considerations, such as the tendency to clinker, must be considered.

A second paper, relating to the power plant, was that of Prof. Forrest R. Cardullo, entitled, "Energy and Pressure Drop in Compound Steam Turbines." This paper was criticized on account of inaccuracies in the author's graphical diagram, and on account of his assumption that the efficiencies of the successive stages are equal to the over-all efficiency, and to each other. It was held that it is important in turbine design to take into account these efficiencies and to establish a correct ratio between the steam and blade velocities.

G. C. Anthony's paper on "A Pressure Recording Indicator for Punching Machinery," described a new method of directly recording the stresses due to punching boiler plates.

STEEL WORKS SESSION.

The final professional session of the meeting, held Friday morning, considered the application of machinery adapted to the use of iron and steel works. Two papers of somewhat similar import were those of R. H. Rice and W. Trinks, entitled, respectively, "Commercial Application of the Turbine Turbo-Compressor" and "Reciprocating Blast-Furnace Blowing Engines."

Automatic Telephones in Chicago.

The Illinois Tunnel Company, which is installing the automatic telephone system in Chicago, succeeded in meeting the terms of the ordinance requiring that 20,000 telephones should be installed by June 1, and has already a total of over 45,000 contracts.

Statistics prepared by officials of the company show that the conduits and cables already installed are sufficient to give service to 70,000 subscribers. There are 255 miles of cables, or 982,295 miles of wire located in the city tunnels, and 236 miles of conduit outside the tunnel district. Lines run from eight exchanges.

Several public pay stations have been installed. For these the charge per call will be three cents. Installations in offices, stores, and residences are at a flat rate, with slot service eliminated.

Electrical Exports for April.

The Bureau of Statistics of the De partment of Commerce and Labor, Washington, D. C., has completed its monthly summary of the imports and exports of the United States for the month of April, 1911. From this the following facts relative to the electrical exports are obtained.

The figures for April are particularly gratifying. The total electrical exports and the figures for the appliance subclass exceeded all previous monthly values. The electrical machinery ex ports were heavier than in any month for the last three calendar years. The comparative monthly figures are as follows:

Month—	Electrical Appliances.	Electrical Machinery.	Total.
April, 1911	$1,064,562	$888,283	$1,952,845
April, 1910	959,186	484,658	1,443,844
March, 1911	915,001	639,338	1,554,339

A list of the principal countries to which electrical products were sent in April and the value of these shipments is as follows:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$ 47,980	$ 54,957
Canada	355,314	154,403
Mexico	84,084	165,378
Cuba	73,404	5,608
Brazil	164,548	137,941
Rest of South America	60,993	26,749
Japan	132,024	112,807

Exports of Copper for the Fiscal Year 1911.

Copper seems likely to make a large gain in exports for the fiscal year ending June 30, 1911, though this will probably not equal in value the exports in 1908. The total value of copper exported (not including ore) in the ten months ending with last April was $86,000,000, and in the month of April alone $9,000,000, suggesting that the total for the fiscal year will fall but little below the $100,000,000 line, though it evidently will not equal the figures of 1908, when the total was $104,000,000 in value. In quantity, however, the total for the year may make a higher record than in any earlier year.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

ELEMENTS OF POWER-STATION DESIGN.—XXXIV.

CONTRACTS AND SPECIFICATIONS.—I.

BY W. B. GUMP.

The subject of contracts and specifications is so broad that many volumes could not cover it. Yet, as in all engineering undertakings, we look first to the fundamentals and from these we finally reach out to the details, basing them chiefly upon experience.

It is the purpose here to take up some of the fundamentals which are among the first in importance, and to discuss also some of the details which are related especially to the design and installation of power plants. Complete specifications of certain apparatus will be given in detail and may serve as a foundation upon which the engineer should base his specifications for similar apparatus.

The purpose of engineering specifications is in general to define clearly the work which is to be done, the manner of doing the work, the materials to be employed, the quality and quantity of materials used, the duration of time allowed for the performance of the work, the sum which is to be paid, and finally the terms of payment.

When power-plant machinery is to be purchased, the time of delivery is generally stated, and in many cases a penalty clause is inserted which provides for damages from the party furnishing the machinery in case of failure to deliver within the time specified.

An engineering contract, to be valid, must be physically possible, the parties must be competent to enter into the agreement, the matter as stated must be lawful, and in general there should be what is commonly termed a valuable consideration. Sealed contracts (those drawn up and executed under a seal) do not require a consideration.

The requirements as to competency are that the parties shall be mature, sane, and responsible. A contract entered into by an agent, or representative, is valid provided the principal is competent to enter into the contract.

It is the custom to have a contract in writing. A verbal agreement is entirely valid, but in most cases difficulties are avoided by having all of the clauses in writing. The statements should be in plain language, free from ambiguity. Legal terms should be used with discretion, for the reason that if they are not thoroughly understood, their meaning may become the subject of a controversy which will develop into litigation. Important contracts, such as those involving projects of extremely large magnitude, should be prepared with the assistance of a reliable attorney in order to avoid litigation. The class of contracts ordinarily entered into are comparatively simple, and may be prepared without any particular difficulty.

It is important to have well fixed in mind the work in hand, and above all to see that the specifications cover every point beyond any doubt. It is advisable in engineering specifications to generalize, in a way which broadly covers the work in hand, and to follow this general description with such detailed explanations as are considered necessary to fully include all points.

In a large number of cases it will be found that the specifications are above any criticism as regards their relation to high-class engineering, but are not satisfied by the contractor during the construction and when completed, the job is considerably below the standard which the specifications plainly demand. This brings out the fact that competent engineering supervision is absolutely necessary, if the specifications are to be properly carried out by the contractor.

Not a few engineers regard specifications as covering the construction in a manner which leaves no doubt as to efficiency of the workmanship which is to follow. It is needless to state that the experienced engineer often finds his hardest task in seeing that the specifications are lived up to, and in far too many instances he is limited in his power to bring about first-class workmanship. For this reason the contract should be plain as to the jurisdiction of the engineer, so that his authority will be plainly understood from the start. He can then refuse to take hold of the work unless he is allowed to employ the class of help necessary to make the job first-class.

The salient features to be incorporated in contracts and specifications may be summarized in the following:

1. Time of beginning the work, and time of duration before work is completed.
2. Character of work and appliances used.
3. The workmen necessary.
4. Manner of estimating the progress and making payments to the contractor.
5. Jurisdiction of the engineer in charge.
6. Determination of damages sustained by a failure to complete the work as specified.
7. Protection of work completed.
8. Protection to life and property.
9. Protection against claims in connection with the use of patented appliances.
10. Cancellation of contract for default of contractor.
11. Relations to other contractors.
12. Faulty details to be corrected previous to final acceptance.
13. Settlement of disputes.
14. Extra work.
15. Interpretation of the contract, and right of engineer to make changes.

It will be well to take these up individually in the order given.

(1) In general, the time of beginning the work, such as that of a power plant, is as soon after signing the contract as is practicable. For example, the time for commencing operations is usually specified as ten to thirty or

sixty days from date of signing, the time depending on the character of the work. It should be noted that prior to drawing up the contract, the cost of the work has been estimated, and the time required has been computed in order to form a basis for arriving at the progress made from time to time, and to ascertain costs per current month during construction. Payments to employees are usually made each month, and it is convenient to follow the contractor's work and the work of the engineer, by having the records on a monthly basis.

(2) The character of the work should be plainly stated in the introductory remarks of the contract, and it should be made clear who is to furnish the appliances to be used in the work, and furthermore, what sort of appliances are required. For example, suppose that the best class of work is specified, and the contractor undertakes the work with an inferior equipment. It is evident that his work will be below the standard expected and serious delay will likely follow. It is therefore important to insert a clause to the effect that the contractor's equipment and the material entering into the construction shall be subject to the approval of the engineer.

(3) As a rule the engineer should have a voice with respect to the class of labor employed. If first-class work is demanded, it is evident that skilled workmen are necessary. In order to comply with the specifications the engineer should be given the power to discharge employees who plainly show themselves to be incompetent to carry on the work for which they were engaged.

(4) It is the custom for the engineer in charge to make estimates each month of the material furnished on the ground during the preceding month, to be used by the contractor. These estimates serve as a guide for monthly payments, and also permit carrying on the work to completion with less capital than would be required otherwise.

The practice is commonly followed of reserving a portion of the monthly payments, to form a fund upon which to draw for final settlement, especially in connection with damages which result from failure to comply with the specifications.

It is safe to estimate all material delivered upon the ground, including material which does not go into the finished structure, provided the material has undergone proper inspection and has been accepted by the engineer in charge.

(5) It is usual to state in the contract that the decision of the engineer is final. This is done to avoid disputes, and it serves to make the engineer a referee or arbitrator between the principals. An exceptional case is where the contract provides for the examination of the estimates, as to their correctness, this examination being allowed by either or both of the parties concerned. In the latter case the law recognizes the right of either party to enter a plea of fraud against the engineer. If sustained in the court, it nullifies the decisions of the engineer. However, the court ordinarily discourages such proceedings, and in any case it must be clearly proven that gross injustice has resulted by strictly following the clauses of the contract.

No reputable engineer will fail to render justice to the principals, and the confidence that they will be treated fairly in all matters pertaining to the work is evidenced by the signing of the contract.

(6) The manner of determining damages sustained by failure to complete the work as specified involves the interpretation of the contract, and more especially the actual loss after the contract has been terminated or broken. In other words, either party may fail to live up to the conditions, or may break the contract, and the amount of the penalty to be paid is usually ascertained after the contract has been broken, as the time for final settlement naturally comes at the close of the operations involved.

The damages are for compensation to the party for his loss, brought about by reason of said failure to fulfill the requirements. Unless the amount of damages is well defined in the contract the injured party is unlikely to recover an amount exceeding the actual loss, based upon the breach of contract. In order to provide for the recovery of damages it is not uncommon to insert clauses, stating fixed amounts to be paid in case of certain failures which are definitely specified.

(7) The protection of the work completed refers to the care of the finished portions of the structure which must be protected until completing the work as a whole. Even though parts of the work have been completed and accepted they should be protected by the contractor. In case this involves any serious expense to the contractor a clause should be inserted which will prevent any dispute as to what is expected.

(8) It is understood that the contractor is responsible for damages to property and also for injury or loss of life of workmen. It is therefore necessary to introduce clauses which thoroughly cover this point.

(9) In cases where it becomes expedient to use patented appliances for doing the work, and royalties are demanded, or where claims for infringement for using power apparatus may arise, the party authorizing the building of the plant should be protected, and a clause should be included which provides for such protection. Such a clause will be noted in the specifications which are to follow.

(10) Contracts involving large sums may contain clauses providing for cancellation of the contract in the event of certain contingencies which, if allowed to remain, will work injury (financially or otherwise) to the party of the first part, or to others interested, or both. Factors which present themselves in the way of incompetency, violation of the contract, unwillingness, or gross negligence, are sufficient ground for cancellation of the original contract, and a clause concerning such cancellation may be quoted somewhat as follows:

"In lieu of the exercise of the power hereinbefore given, in case of said contractor's default, to employ workmen, purchase tools and materials and complete the work, said board reserves the right and option, instead thereof, to annul and cancel this contract and relet the work, or any part thereof, and said contractor shall not be entitled to any claim for damages on account of such annulment, nor shall such annulment affect the right of said city to recover damages which may arise from such failure on the part of said contractor, or retained under the terms of this contract, shall be forfeited to said city, and be paid to the credit of the fund for extending water pipe in said city; but such forfeiture shall, however, not release said contractor, or his sureties for the fulfillment of this contract, and said contractor and his sureties shall be credited with the amount of the moneys so forfeited toward any greater sum that they may become liable for to said city on account of the default of said contractor."

(11) In cases where two or more contractors enter into the work it is advisable, though not always necessary, to insert a clause defining the obligations of the several contractors to each other.

The reasons for making this point clear are that a clash may arise be-

tween the contractors on account of interference with each other's work, and the delays, errors and annoyances resulting will become detrimental to the proper carrying out of the agreement. It should therefore be made clear that each contractor should work harmoniously with the others, and should so arrange his work that it will properly fit into the work of the other contractors, and will not cause delay in the other portions of the work.

(12) It is generally understood that the work done is not to be construed as accepted unless it is so stated in writing by the engineer. Furthermore, the failure to detect faulty work or incomplete performance, before the time of final acceptance, is not to be construed as acceptance of the work.

It is to be stated further that after final acceptance by the engineer the contract is no longer binding on the part of the contractor, as regards the requirement of specific performance. A clause may be inserted, however, which in case of the appearance of any defect not at first detected, gives the party of the first part a claim for damages to recover any losses due to such defects or non-performance according to specifications.

(13) As a rule the engineer is employed by the party of the first part, and it is generally understood that the engineer is to act in a strictly professional capacity, and he should not show a personal feeling in favor of or against either party. Therefore, it is fitting that the engineer be made a referee in cases of dispute or misunderstanding, and that his decision be made final and conclusive.

(14) It happens frequently that when a contractor has completed a piece of work his bill includes extras which he contends were necessary, but were not included in connection with the specifications. If these extras are left until the time of final settlement, it is evidently too late to include them in the payment as originally agreed upon. In order to avoid complications it is important to note in the beginning to what extent extras are likely to occur, and it should preferably be arranged that bills for extras are to be presented at the end of each month, rather than after the entire work has been completed. By this means serious disputes, unreasonable prices, and kindred annoyances and objections can generally be prevented.

(15) The interpretation of the contract is to be settled by the engineer with reference to four items:

(a) Where the meaning is obscure.

(b) What is implied beyond that which is accurately specified.

(c) Cases of discrepancies between plans and specifications.

(d) Changes of plans, or of methods which are decided after the work has been started.

Keeping in mind the fact that the engineer is the author of the specifications, it will readily be conceded that he is the proper party to interpret them. However clear the phraseology of the specifications may be, certain inherent defects are quite likely to appear and cause arguments, since minute details which are not completely described in the specifications will come to view in the course of the work.

When it is remembered that the contract is rare in which changes of plans are not made, it is clear that due provision should be made for such changes. There are many things which bring about such changes; chief among them are:

(a) Improved method of doing the work.

(b) Obstacles not foreseen.

(c) Plans for reducing the cost.

(d) Plans for improving the quality of the work.

BIDS AND PROPOSALS.

In advertising for bids from contractors it is well to keep in mind that the nature of the work should be explained clearly and as briefly as possible. The object is, of course, to receive as many bids as possible from responsible parties. It is customary to demand that the bids be sealed, and it is stated in the advertisement that these bids (in the form of proposals) will be opened at a certain hour on a certain day.

In order to have the contract binding on the part of the successful bidder, it is requested that a certified check be inclosed with the proposal. The checks of all unsuccessful bidders are returned. The amount of the check is specified and is usually from two to five per cent of the sum mentioned in the proposal. The certified check of the successful bider is held until he signs the contract, and in the event that he fails to become a party to the contract the deposited check is retained as liquidated damages.

The successful bidder is not necessarily the lowest bidder. When bids are invited it is well to note that a certain class of contractors will endeavor to satisfy the requirements with apparatus which is not of the highest quality, and in not a few cases is too small. For example: If a boiler is required to do a certain piece of work, a bid may be made on a boiler which will give the output required, but must be operated beyond its normal capacity. Therefore, if the exact conditions are not specified, an inferior equipment may be selected without full knowledge of its limitations. Regarding this point, it should be stated that the engineer should exercise great care in specifying the conditions to be fulfilled, and the requirements and ratings of apparatus to comply with these conditions.

(To be continued.)

Educating Central-Station Employees.

New York Edison Company will start a new school about October 1. All new employees of the contract and inspection departments as well as of the thirty-one sub-departments will have to attend two weekly sessions of two hours each. This will be taken from company time, however, and while compulsory for new employees will be optional for any old employee of the contract and inspection department. It will not only be a schooling of salesmen but of the men and women who come in touch with the public.

The new school is quite distinct from the technical school which has been free to employees and has been maintained for some years in the library and laboratories of the company. The new school is not only to make the employees of all the contract and inspection departments more intelligent, but to enable the employee of one subdepartment familiar from the start with the conditions and details of all the others. Edison company officials expect large benefit from the school in the way of securing new business.

The establishment and development of this school shows the active and progressive steps taken by the New York Edison Company to get closer to its public and to obtain new business. This company recognizes that a large part of the public governs its attitude toward the public utility corporation by the character, intelligence and appearance of the employees with whom it comes in touch.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Units for Street Lighting.

In designing a type of prismatic-glass unit which will be suitable for street

FIG. 1.—HOLOPHANE STREET-LIGHTING UNIT.

lighting, three aims must be kept in mind:

(1) To increase the percentage of light directed below the horizontal, which in many tungsten lamp-post installations is as low as forty per cent.

(2) To eliminate glare so as to make

FIG. 3.—A POST EQUIPPED.

the lighting comfortable to pedestrians and effective for their eyes.

(3) To make the unit easy to clean and to reduce the loss of light due to the deposit of dust if not cleaned regularly.

Both of the two last named aims have been attained by using a diffusing globe or envelope which surrounds the primatic glass reflector, preventing the dirt from settling on the prisms where it might be tightly held by moisture. Having a smooth opal exterior, this outer globe readily sheds the rain and dust and so diffuses the light that the entire surface of the unit glows with a low brilliancy. The same unit can be used with 60 and 100-watt tungsten lamps on either multiple or series circuits; also with 40-watt multiple and 32-candlepower series lamps, the correct position of the lamps being assured by a suitable socket-holder as shown in Fig. 2. Where the design of a post also demands a central upright lamp (as in Fig. 3), no prismatic reflector is used in the upper globe, which is made of the same opal globe and which is fitted with a lamp of lower candlepower than the pendent units on the same post.

Thanks to the prismatic inner globe, the distribution of the light is decidedly downward, thereby reducing the waste of light radiated above the horizontal. Figures submitted by the Holophane Company show the percentage of the

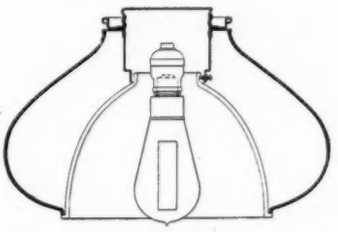


FIG. 2.—DIAGRAM OF INTERIOR.

total light of a lamp delivered below the horizontal to be:

	Per cent
With twelve-inch opal ball.....	45
With twelve-inch sand-blasted ball..	50
With Holophane No. 591 unit.....	70

Moreover, only a very small part of the light thus delivered below the horizontal by the Holophane unit lies between the angles of sixty-five degrees and ninety degrees with the vertical—the angles in which the light produces the obnoxious glare in street lighting. This absence of glare is

FIG. 4.—RACE STREET, CINCINNATI, O.

clearly shown by the illustration of Race Street at Cincinnati (Fig. 4) as lighted by posts supporting four such units; the absence of halation in the picture shows a practically glareless lighting. In this case the posts are directly opposite each other on a street forty-five feet wide, the posts being fifty-seven feet apart and each having four 100-watt lamps in the pendent globes besides a sixty-watt lamp in the upright globe. How much superior the resulting illumination is (in both the intensity of the light and the uniformity of distribution) to the ordinary twelve-inch opal balls fitted with the same lamps, is shown by Fig. 5, which gives the calculated[1] light distribution for both along the center line of the street. This comparison implies that the lighting at the center of the street, midway between two pairs of posts, would be four times as intense with the Holophane units as with the usual opal globes.

As to spacing the units, the advisable

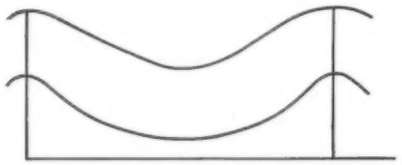


FIG. 5.—LIGHT DISTRIBUTION ALONG CENTER OF STREET WITH OPPOSITE LAMPS OF SAME WATTAGE.
100-watt Lamps mounted 13.5 feet above the street. Lower Curve: with 12-inch opal balls. Maximum foot-candles, 0.64; minimum, 0.16. Upper Curve: with Holophane No. 591 units. Maximum foot-candles, 1.12; minimum, 0.64.

distance between them is limited by the fact that they emit little light above sixty-five degrees. This distance can easily be figured for any height of mounting, as the ray of light leaving the unit at sixty-five degrees from the vertical reaches the ground at a distance from the unit equal to 2.14 times the height of the unit above the ground. Therefore, if areas of low illumination between adjacent units are to be avoided, the units must not be spaced at a greater distance apart than 4.3 times the mounting height. In actual practice, units may be separated at five times the mounting height without causing a seriously objectionable lack of uniformity, but the uniformity would be much improved by reducing the spacing factor to four.

For good practice, five different arrangements of posts equipped with the new Holophane units may be used on streets of different types and widths,[2] as in Fig. 6.

(1) For suburban and outlying streets not over eighty feet wide, the lamps may be placed in *a single line* down the center of the street, with a spacing not over five times the height at which the units are mounted. However, the width of the street should not exceed the spacing between the units. Thus, units mounted at a height of twelve feet may be placed sixty feet apart and used on streets up to sixty feet in width; for wider streets, the mounting height of the units should be increased to one-fifth the width of the street, the spacing being increased to the width of the street.

(2) For the lesser business streets and for general lighting of residence distrists, a *staggered arrangement* may be used with streets twenty to eighty feet wide. Then the recommended mounting height corresponding to various street widths and lamp spacings will be as shown in Table I.

TABLE I.—STAGGERED ARRANGEMENT.

Width of Street in Feet.	Maximum Separation "D" Recommended for Various Mounting Heights.						
	12	13	14	15	16	18	20
20	57	62	67	72	78	88	98
25	55	60	65	70	76	87	97
30	52	58	63	69	74	85	96
35	49	55	61	66	72	83	94
40	45	51	58	63	69	81	92
45	40	47	54	60	66	78	89
50	..	41	49	56	62	75	87
55	..	..	44	51	58	71	84
60	..	..	..	45	53	67	80
70	..	..	..	..	..	56	71
80							60

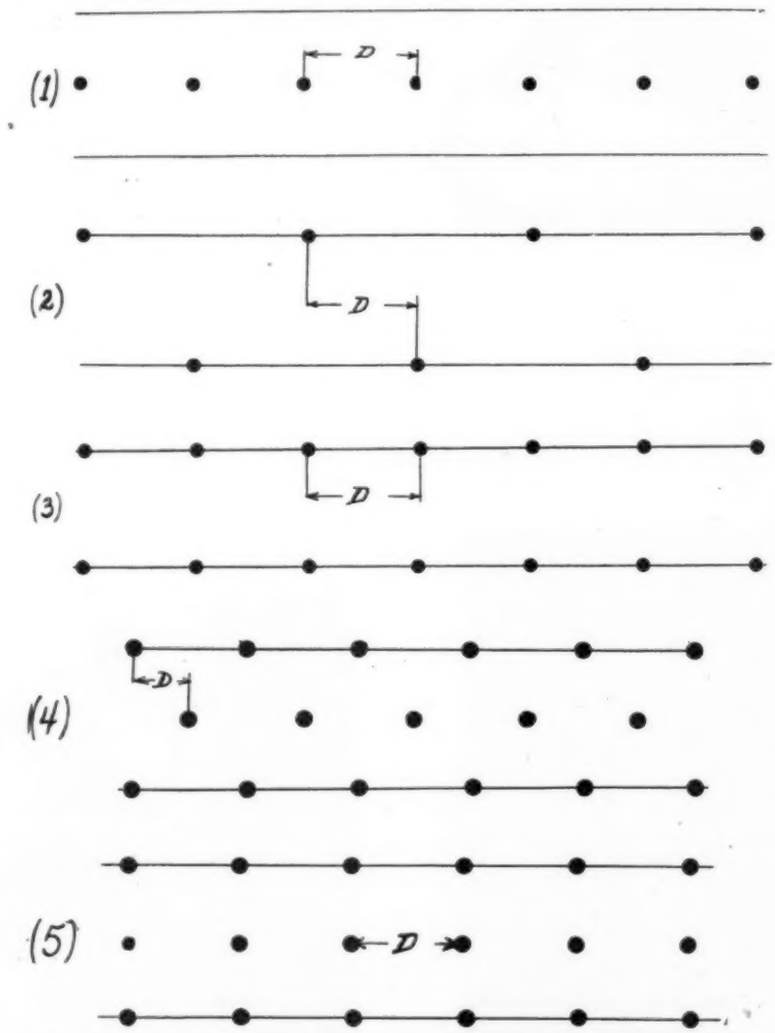


FIG. 6.—PROPOSED ARRANGEMENT OF STREET LAMPS.
(1) Single Line. (2) Staggered. (3) Opposite. (4) Opposite with Staggered Isles. (5) Opposite with Opposite Isles.

(3) For business streets, wide boulevards and important residence streets where a nearly uniform illumination of relatively high intensity is required, this can be obtained by a so-called *opposite arrangement*, placing the lamp units in parallel rows, as shown in the Cincinnati illustration. This plan is suitable

1 In the words of Dr. Louis Bell: "By all means the most reliable method of determining [street] illumination is, in my judgement, computing it from the known distribution curves of the radiants."

2 The spacings given hereafter are the allowable maximum. A still more uniform distribution of the light would be obtained in each case by a twenty per cent decrease in this spacing.

for streets fifty to 100 feet wide, the recommended spacing being as shown in Table II.

TABLE II.

Width of Street in Feet.	Maximum Separation "D" of Posts in Feet.	Mounting Height of Unit in Feet.
48 to 60	48	12
52 to 65	52	13
56 to 70	56	14
60 to 75	60	15
64 to 80	64	16
72 to 90	72	18
80 to 100	80	20

(4) For similar but wider thoroughfares (eighty to 160 feet wide), where lamps can be placed in the middle of the street, the Holophane Company recommends an *opposite arrangement with staggered* isle of safety. To determine the spacing of units in this case, one-half of the street may be figured as a staggered system and the units duplicated for the other half.

(5) Likewise, for streets 100 to 200 feet wide, an *opposite arrangement with opposite isle of safety* may be figured by dividing the street into halves and judging each by Table II.

These prismatic street-lighting units (known as Holophane No. 591) are already in use in Cincinnati, O.; Alexandria, La.; Brooklyn, N. Y., and Newark, O. They are also being tried in thirteen other cities.

Work of the German Patent Office.

Of the 45,000 applications for patents made every year to the German Patent Office, two-thirds are rejected after correspondence or personal interview with the applicants. The Patent Office came into existence only thirty-three years ago, but its operations have now grown so that nearly 300 lawyers, with clerks, make a living by representing patentees.

In Germany an invention to be granted a patent must have a commercial value and must not have been already patented; more than that, the Patent Office must be satisfied that the invention is going to be of real practical value for some branch of industry which the patent law enumerates. Perhaps no patent office in the world is so strict and seaching as the German, and it is claimed that as a result there are fewer fetters on trade, fewer sham patents, and less patent litigation in Germany than in any other country.

Working of Foreign Patents.

Germany, Great Britain, Canada, Belgium, Austria-Hungary and Italy require that patents taken out in these respective countries be forfeited unless worked within a certain period.

LETTER TO THE EDITOR.

Gas and Electric Street Lighting.

To the Editor:

While anonymous criticisms like the one made in your issue of May 27 by a New York gas engineer, rarely deserve attention, some statements in this letter might be taken too seriously if not refuted. Thus, the implication that a grouping of mantles in itself shows a gain in lighting efficiency, will be new to many, as it has been commonly understood that the gain in efficiency will come only when the group of mantles is placed in a tall stack, which stack is too often absent from the street gas lamps. Indeed, as pointed out last fall by Professor Whitaker in his Johns Hopkins lecture before the Illuminating Engineering Society, it is necessary to have such a stack in order to even approximate the efficiency of the individual burner in a grouped-mantle lamp. Such is the interference of the mantles with one another.

As to the rapid deterioration of mantles, this has only approximated the expectations of the celebrated Professor Bunsen, who doubted if the ingredients could be made to hold together at all. One need not go outside the ranks of the staunch gas advocates for proofs of the same even regarding the so-called high-grade mantles. Thus Hole, in his "Distribution of Gas" (1909 edition) claims that the Welsbach-Plaissetty mantle deteriorates only twenty-five per cent in 400 hours, while the Welsbach "C" mantle showed a reduction of forty to fifty per cent in its candle-power during the same length of time.

As to the displacing of electricity by gas for the street lighting of Westminster (London), it must be remembered that gas had been entrenched there for decades and that electricity had been gradually crowding it out. To stop this march of progress, the gas company cut the price of gas to about forty per cent. of its former figure, thereby securing a new contract under which sixty-six electric arcs are replaced, while 1,100 are still left in service in this section. Just how much the gas company will have to charge to advertising in thus furnishing street lamps at a figure undoubtedly far below actual cost, does not matter. The point to which your correspondent has kindly called attention to is this: That in London the gas people had to slash their lighting rate to replace even sixty-six electric arcs, while the electric rivals placed over 13,000 additional street lamps in London during 1910 without such price cutting.

ALBERT SCHEIBLE.

Chicago, May 31, 1911.

Incandescent Lime Cathodes.

At a recent meeting of the London Physical Society, a paper by R. S. Willows and T. Picton, on the behavior of incandescent lime cathodes, was read.

Wehnelt has shown that incandescent lime emits a large number of negative ions; if, therefore, hot lime is used as a cathode, a discharge may be obtained in a vacuum-tube with potential differences as low as thirty volts. The alteration with time of these cathodes, under continued use, has been investigated, and the following results obtained: (1) When lime is heated on platinum foil, so far from showing fatigue, it actually increases in activity. With potential differences greater than the saturation voltage this increase may be ninefold. At lower voltages a slow but steady increase up to 100 per cent has been found. The steady activity falls when the lime is cold; the initial activity may greatly increase. (2) When the lime is heated on nickel foil, if the tube carries a heavy discharge, the current increases to a maximum, and then decreases. A greatly increased activity is frequently shown after the lime has been cold for some hours. At the lower voltages the same general variations are shown as with platinum. (3) Great irregularity is frequently shown when the current is first started; at this stage other causes than temperature, such as mechanical vibrations, greatly influence the emission of ions.

The films were very adherent to the platinum. It was impossible to render the platinum free again from the activity with which the lime endowed it. There was no connection between the activity and the quantity of electricity passed. The increase of activity was probably due to the CaO diffusing into the platinum.

Radium Found in Australia.

A number of rich deposits of ores containing radium have been found in Australia. Near Mount Poynter in South Australia is found uranophane, which contains sixty-seven per cent of uranium trioxide. In Western Australia has been found pilbarite with twenty-seven per cent of uranium.

TELEPHONY—TELEGRAPHY, and WIRELESS.

Long-Distance Telephone Situation in Canada.

Two decisions, both very interesting to telephone users and to telephone companies, have been recently handed down.

The Ontario Railway and Municipal Board laid down the principle not to approve of any contract between a local telephone company and the Bell Telephone Company where this contract precluded any other independent local company from exchanging business with the Bell Telephone Company. This decision would indicate the ultimate freedom of the independent and rural telephone subscriber from telephone monopoly.

Following this decision came the decision of the Dominion Railway Board instructing the Bell Telephone Company to receive long-distance messages from any independent company which will install the necessary connections and pay a certain established fee. Although the Bell Telephone Company strenuously opposed this suggestion on behalf of the board by the chairman, yet there is a feeling that the company will earnestly endeavor to carry out the wishes of the board for one year in this matter, so that there are hopes of the rural districts of Canada securing a much more advantageous telephone system than heretofore has been possible.—*The Canadian Engineer.*

Weather News for Rural Lines.

Beginning July 1 the Southern Bell Telephone & Telegraph Company will put in operation a scheme for furnishing the patrons of its rural lines in the vicinity of Montgomery, Ala., with advance news regarding the weather.

A simultaneous gong alarm will be sounded in all of the farm houses promptly at the hour of noon, and the central office at Montgomery will tell the rural subscribers what the weather man says about the climate. The idea has proved a most popular one, and the innovation is being eagerly awaited.

Loud-Speaking Telephone at a Railway Station.

Much public interest has been aroused by the loud-speaking telephone adopted by L. C. Fell, chief engineer of the London County Council Tramways, for facilitating the handling of traffic during rush hours at Blackfriars Bridge, London. At the stopping place on the north side of the bridge, there are immense crowds every evening waiting for the cars going

TELEPHONE RECEIVER WITH TRUMPET.

southwards. A shelter has recently been completed under which the lines form. This is roofed in and consists of a central part about twenty-six yards long in front of which the cars stop, and two approaches, one on either side, each divided by low galvanized-iron partitions with four passages, 22.5 inches wide. These approaches are about seventeen yards long, and the names of the routes for which the eight lines form in them are displayed in illuminated signs at the end of each. As each car approaches, the official who is called the "Regulator," allows only as many people to pass from the corresponding line to what may be called the "landing stage," as there is room for in the cars. This avoids any struggling for precedence on the arrival of the car, as the passengers know that there is room enough for all.

It is to save time when the car arrives at the stopping place that the loud-speaking telephones have been installed. A transmitter is fixed on an electric-light standard at a stopping place about 100 yards before the shelter, and is connected to two receivers in the shelter just above the heads of the two "regulators" there. The instruments have been supplied by Alfred Graham & Company, and are of a similar pattern to those used for ship telephones, being inclosed in painted gun-metal cases. The transmitter is a carbon-granule instrument with carbon diaphragms, and the set is direct-working, no induction coil being employed. When the transmitter is to be used, a switch handle is pulled down, which, in addition to connecting up the circuit, removes the protecting cap from the diaphragm, and moves the microphone to shake up any packed granules. Eight six-block agglomerate Leclanche cells are employed. A twin 16 S. W. G. vulcanized-rubber lead-covered cable, laid in an existing subway under the road, connects the transmitter with the two receivers. The receivers are of Graham's standard loud-speaking pattern fitted with a twelve-inch sound-amplifying trumpet, and they are connected in parallel. The trumpet is shown in the figure.

Wireless to Africa.

A wireless message has been sent from the Glace Bay station to Dakar, on the western coast of Africa, the toal time taken being only one hour. The message was sent to the Eiffel Tower station in Paris, and then relayed to the Dakar station.

A SIMPLE APPLIANCE FOR TELEGRAPH STATIONS.

BY H. P. CLAUSEN.

A number of arrangements have been designed for automatically closing the telegraph circuit at a station should the operator inadvertently leave the circuit closer of his key open. Without any arrangement supplied at the station and with an open key, the service is usually tied up between the terminal points of the circuit with the resultant delays.

It is the purpose of the present article to discuss a simple means for overcoming this difficulty without calling for the installation of any clockwork or apparatus requiring winding or special setting.

Fig. 1 shows an intermediate station in opposite directions. The main-line relay is shown by *R*, the key by *K* and with the east and west lines, leaving it the sounder *S*. These, together with local battery *B*, are connected in the usual manner. With this arrangement the key *K*, when left open, breaks the

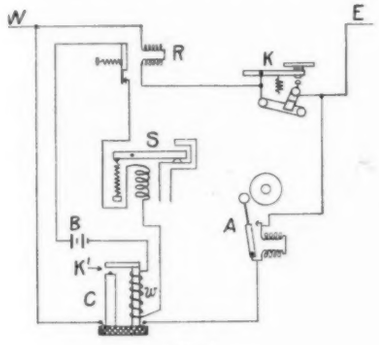


FIG. 1.

line circuit and thus no means are provided for working through the station until the break in the circuit is closed. *C* represents the automatic circuit-closing device and *A* an alarm signal. *C* is a device which may be of the ordinary heat-relay construction, similar in operation to the devices which operate the advertising lamps which automatically light and extinguish in the well-understood manner; but in the present instance, the circuit connections are slightly different.

It will be observed that the sounder *S*, battery *B*, and winding *W*, which is a part of the heat relay, are connected in series, so that, under normal conditions, with the main-line relay *R*, having its armature drawn up, current passes through the local circuit and expands the movable element of the thermal relay *C*, keeping the contact K^1 open. From the line wire *W* a tap wire is run down to one of the connecting terminals of the thermal relay; the remaining connecting terminal extends to the winding of the alarm bell *A*, the remaining terminal of which then connects to the line wire *E*.

With this arrangement it will be observed that should the contact K^1 close, the line relay *R* and key *K* are shunted

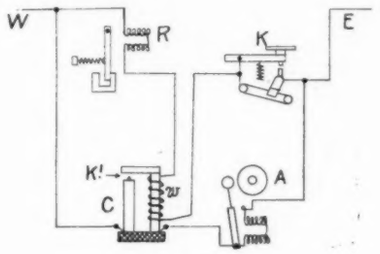


FIG. 2.

out of circuit, and thus there is no tendency for the thermal relay to open the contact. It will further be observed that the adjustment of the thermal relay must be such that with ordinary telegraphing the winding *W* receives sufficient current for keeping the contact K^1 from closing. Therefore, it is necessary to so adjust the relay that when the key *K* is left open for, say, possibly a period of two minutes, the circuit will close, and when it does close, messages may be sent over the branch circuit thus established. Therefore, the alarm *A* will sound while the circuit is being worked over.

Now, should the operator return, he will find that he cannot immediately proceed to send messages over the line, but he does know that the circuit-closing key should be thrown over and, when this is done, the relay *R* receives current, draws up its armature and re-establishes a flow of current through the local circuit, including the winding *W* of the thermal relay, opening the contact K^1 in whatever time his relays are adjusted to operate, as stated, usually within the period of about two minutes.

Fig. 2 shows another arrangement of circuits, including the same protective apparatus. Here the thermal relay *C* is connected in series with the main line. With this arrangement a key left open will cause the relay to place the bridged circuit around it, and will also close the alarm circuit as described above. This arrangement is particularly suitable for use in connection with stations where no local sounders are used, the work being done with main-line sounders.

Fig. 3 shows a simple form of thermal relay and gives the principle of its operation. Normally, when cold, the contact is closed. Upon conducting current through the winding, the length of the post increases, therefore tending to separate the two contacts. If we make the post quite long, say three or four inches, and construct the expanding member from bismuth, lead or zinc, which have quite high coefficients of expansion, then we obtain considerable movement.

It will immediately be objected that if the expanding element responds to heat applied through the winding, it will also respond to local temperature changes. This would seriously affect the operation of the device were it not for the fact that the contact post is practically of the same length as that portion of the post wound with the wire and, being of the same material, we have precisely the same relative expansion between the two posts whatever the range of temperature may be in the place where the thermal relay may be installed. That is to say, if it will expand one thirty-second of an inch in zero temperature, with a certain amount

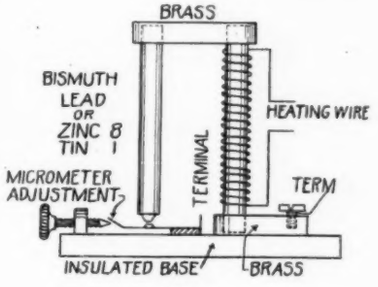


FIG. 3.

of heat applied through the winding, it will also expand the same distance with a much higher surrounding temperature.

The arrangement above outlined is very simple to build and gives a surprisingly reliable service. It is obvious that the alarm bell *A* need not be installed, but it will always be necessary to have in the shunt circuit a resistance equal to at least the line relay so as not to change the circuit conditions, and also permit the circuit to re-establish itself without further attenion, after the attendant has closed the circuit-closing switch associated with the key. Therefore, the alarm bell may as well be installed, which would undoubtedly result in more prompt attention to the closing of the switch.

New Electrical and Mechanical Apparatus and Appliances.

Storage-Battery Trucks for Handling Freight.

The Automatic Transportation Company's electric truck shown herewith, is specially designed and constructed for handling package freight at railway and steamship terminals, freight houses, manufacturing plants, wholesale establishments, warehouses, storage plants, and all institutions requiring trucking about the premises. This truck is equally efficient in handling baggage, mail and express matter in and about passenger stations.

The operation of the truck is most simple. It may be operated with equal efficiency forward or back by a porter or unskilled laborer. The truck is easily controlled and may be readily turned in a very small space. The power for operating is supplied by storage batteries in a steel receptacle, as shown at the left of the truck. The construction is such that the batteries may be easily removed.

One charge of electricity, it is said, will operate the truck for an entire day or night, at a total cost of but a few cents for power. The truck is very powerful and negotiates grades with ease. It will cover the same distance in one quarter the time required for hand-operated trucks and do its work quickly and efficiently.

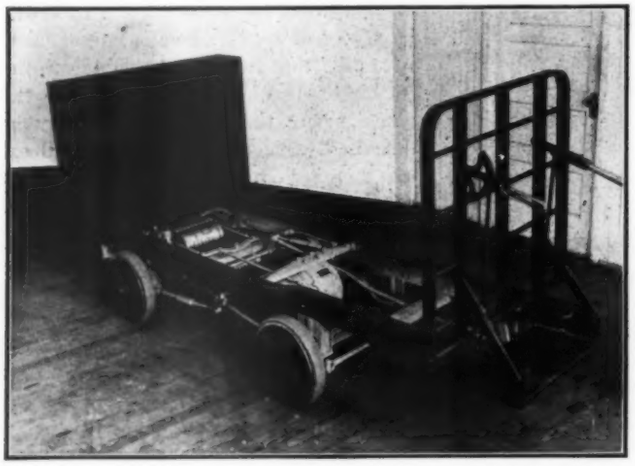
One end of the truck is rigid and contains the batteries for power. The other end consists of a movable gate hinged at the bottom, which may be lowered, thus increasing by three feet the available loading platform. Springs mounted on the axles support the platform, and these, with the rubber tires, make the operation of the truck easy and noiseless, so that loads of fragile merchandise may be moved without danger of injury from vibration or being shaken off the truck.

The truck is made in a standard size which experience has found to be most convenient. The loading space is forty-two inches wide, and the length seven feet one inch, or with the lowered end gate, ten feet two inches. The height of the freight-truck platform from the floor is twenty inches. Express, mail, and baggage trucks are made in thirty-six-inch heights from the floor. The truck runs on solid rubber-tired wheels, having a diameter of sixteen inches, wheel base of fifty inches, and gauge of thirty-six inches.

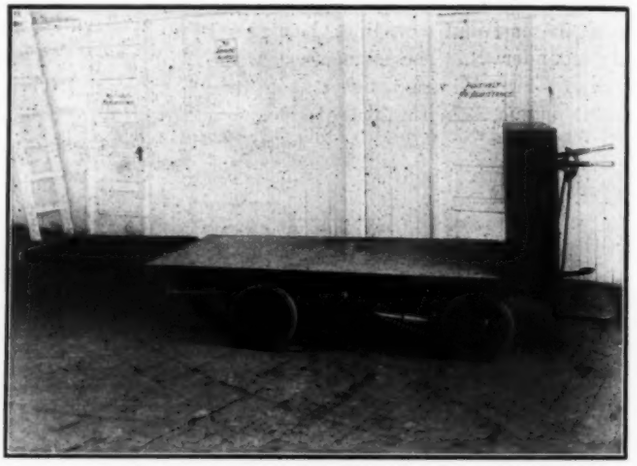
Although this standard pattern of truck is made with loading space forty-two inches wide, trucks designed for special purposes may be made with platforms sixty inches or wider, as occasion necessitates.

The truck may be operated at a speed of from two to ten miles an hour, and is so constructed that it may be driven directly into a freight car, turned to either extreme end, loaded and unloaded, and reversed to the platform, thus reducing the handling to a minimum. The truck weighs 1,800 pounds and will carry from 2,000 to 4,000 pounds.

These trucks are manufactured by the Automatic Transportation Company, 2933 Main Street, Buffalo, N. Y.



STORAGE-BATTERY TRUCK WITH PLATFORM REMOVED.



VIEW OF TRUCK SHOWING END LOWERED.

Improved Starting Compensators for Induction Motors.

For the advantageous operation of squirrel-cage induction motors, and for rendering them unobjectionable on mixed lighting and power circuits, it is necessary to use a starting device, which will reduce to a minimum the amount of current taken from the line by the motor in starting.

The design of the squirrel-cage motor permits of the use of either resistances, reactances, or compensators for this purpose. Resistance and reactances are only partially satisfactory, however, as they merely serve to reduce the current taken from the line by limiting it to the amount required to start the motor, but fail to reduce the magnitude of the voltage variations produced on the line to the extent required for proper regulation on lighting circuits.

On the other hand, compensators have a transformer effect, that is, they maintain the volt-amperes taken from the supply circuit approximately equal to the volt-amperes on the motor circuit and reduce the starting current to one-fourth the amount the motor would take if directly connected to the line or to one-half the amount taken through a resistance or a reactance, at the reduced voltage required to start the motor and bring it up to speed. Furthermore, by their proper design, it is practicable to absolutely prevent

the motor from being thrown directly onto the line at starting, through the ignorance, carelessness, or hastiness of the operator, and also to compel the operator to start the motor properly at all times and under all conditions.

The manner in which these results may be reliably obtained, together with the means employed to protect the motor against the effects of overloads and voltage failure, are found in the improved hand-operated starting compensators designed by the General Electric Company for standard two-phase and three-phase Form K motors.

These starting compensators consist of an inductive winding with taps, a switch for connecting the taps to the motor, and a hand-operated lever handle and automatic release mechanism for operating the switch.

The winding comprises a coil for each phase wound on a separate leg of the laminated core, and provided with several sub-voltage taps, any one of which may be selected, by trial, as suitable for the starting requirements of any particular case.

Since motor starters are very liable to be located in damp or wet places, the coils are constructed with great care. They are first baked in a high vacuum until every particle of moisture has been driven out, and then an insulating compound, in a molten state, is forced into the interstices of the coils, under great pressure. The subsequent solidification of the compound upon cooling, renders the coils absolutely moisture proof, and adds greatly to their mechanical stability and to the long life or serviceability of the whole apparatus.

The switching device consists of heavy-pipe contacts, immersed in oil, and carried by a substantial switch shaft extending through the sides of the compensator case. To one end of the switch shaft is attached the hand-operated lever, and to the other end, the external-spring return lever, through the medium of which the automatic release devices operate in conjunction with the hand-operated mechanism.

The switch has three positions, the "off" position being located in the middle between the starting and running positions. A latch, pivoted on the side of the compensator case and operating by its own weight, has a notch, which engages a spur on the lever handle to hold the switch in the off position. The shape of the latch and the midway location of the off position, positively compel the proper starting of the motor regardless of any shortcomings whatsoever on the part of the operator.

The automatic release mechanism consists of overload and no-voltage relays, tripping levers, and spring-return levers, which operate automatically to return the switch to the off position from either the starting or running positions, if it should happen to be carelessly or accidentally left on the former, or in case of overloads or voltage failure when it is being held on the latter.

The spring-return levers are mounted on the switch shaft and are actuated by a spring against the tension of which the switch is thrown by the lever handle to either the starting or running positions. Consequently, if at any time the switch should happen to be left on the starting position, the tension of the spring will automatically return it at once to the off position. On the other hand, when the switch is thrown to the running position, the tripping lever of the no-voltage relay engages the external spring-return lever and holds the switch in that position until the spring-return lever is released either by hand, or by the dropping of the plunger of the no-voltage relay, in case of either overload or voltage-failure, thus permitting the spring to return the switch to the off position.

The overload release comprises two series trip coils inserted in the running circuit. By the use of oil dash pots they are unaffected by the usual rush of current at starting, but can be adjusted to operate on a slight increase in current above normal and to open the no-voltage relay circuit, thus allowing the switch to be snapped back from the running to the off position by the action of the spring.

Another important advantage of the automatic overload release is the protection afforded against single-phase operation, for, if the overload relay is properly adjusted, it will be tripped by the increase of load due to the motor running single-phase.

These starting compensators are built in two types—the wall-suspension type and the floor type. The former includes the following sizes: Sixty cycle, 5 to 200 horsepower; forty cycle, 5 to 135 horsepower; and twenty-five cycle, 5 to 100 horsepower. Those of the floor type are suitable for larger motors.

The size of compensators with self-contained oil switches are necessarily limited by the size of the switch. They can be obtained, however, for motors up to and including 550 volts, when the normal current does not exceed 300 amperes per phase, and for motors from 1,040 to 2,500 volts and a current not exceeding 125 amperes per phase. For motors of higher voltage or current capacity the switching device is made separate and consists of triple-pole and four-pole switches for three-phase and two-phase motors, respectively.

This type of compensator is suitable for synchronous motors also, unless the latter operate under conditions requiring very low torque, or where such conditions are taken advantage of for avoiding line disturbances. In such cases the compensators for large synchronous motors are provided with a large number of taps and a controller, by means of which a comparatively low voltage is employed for starting and bringing the motor up to synchronous speed, while the machine field-current adjustment for each successive increase in voltage reduces to a minimum the current taken by the motor in passing from the starting tap to the full line voltage.

Telephone Train Dispatching.

The Pittsburg & Lake Erie Railroad will soon be using the telephone to dispatch its trains on two divisions. This road has just placed an initial order with the Western Electric Company for fifteen telephone selectors and the necessary telephones and auxiliary apparatus to equip two train-dispatching circuits.

One circuit, for eight stations, will be put in between McKeesport and Brownsville, Pa., a distance of forty miles.

The other circuit, equipped for seven stations, will be installed between McKeesport and Connellsville, a distance of forty-three miles.

Coal Production of Texas.

Statistics collected on the production of coal and lignite in Texas, show that in the year 1910 the amount of the former mined was 1,128,947 short tons, and of the latter 979,232 short tons. During the past ten years the total production of coal has been 8,844,207 short tons and of lignite 5,311,902 tons.

New Nursery Milk Warmer.

With the Westinghouse electric nursery milk warmer, shown in the accompanying illustration, a bottle full of infants' food will be heated, to the right temperature for the baby, in three minutes after the switch is turned on. Although intended primarily for heating infants' food, the milk warmer, without the bottle, can be used for heating or boiling any liquid and is convenient for heating water for the sick room, for shaving and for similar purposes.

A heater of the Westinghouse cylindrical immersion type is used. When in use, the heater is wholly submerged in the water to be heated. All of the heat developed in the heater must, therefore, be transmitted to the water. The heating element is hermetically sealed within the walls of the copper jacket forming the heater and is thus effectually protected against oxidization. The heater is said to have an indefinite length of life if operated on normal voltage.

By merely turning it to a position

NURSERY MILK WARMER.

where a slot in the rim permits of its being taken out, the heater can be removed from the water vessel.

A nursery bottle and nipple of Hygia manufacture are supplied with each warmer. While being heated, the bottle sets in a water bath and in the cylindrical heater, which, in turn, rests in the water vessel. The water bath is an important feature of the heater, as infants' food cannot be burned and thereby rendered indigestible if heated in a water bath.

A current-tap attachment plug is furnished with each milk-warmer outfit. This plug screws into any Edison base lamp socket and a socket to accommodate the plug on the milk-warmer cord. By using it the warmer and an incandescent lamp can be operated from the same outlet. The warmer takes 500 watts and operates with either alternating or direct current.

An Instrument for Testing Magnets.

An instrument for testing and comparing the strengths of magnets of various sizes has been brought out by the Reliance Instrument Company, Chicago, Ill., and is shown in the accompanying illustration. A steady current

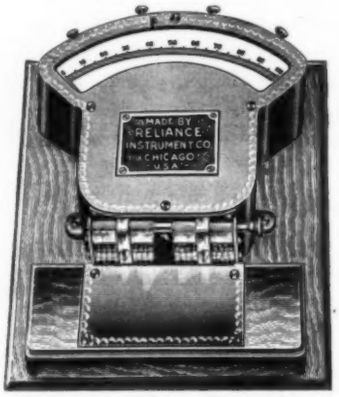


FIG. 1—RELIANCE TESTING INSTRUMENT.

is sent through the moving coil of the instrument from a storage battery and the magnetic field which causes the deflection is produced by the permanent magnet to be tested. This is brought in contact with two adjustable, hardened steel points. Any magnet with an air gap between the poles of from 0.5 to 5.0 inches may be tested and it is not necessary that the surface of the magnet should be finished. Where

FIG. 2—CHARGING AND TESTING BOARD.

only one size of magnet is to be tested an instrument can be supplied with fixed contact points.

Such an instrument is very valuable for testing the uniformity of permanent magnets and also for testing the strength from time to time of magnets which are being aged.

It is essential to have a source of direct current for use with the instrument and the most convenient means of supplying this is from a single cell of storage battery. To facilitate the use of such a battery a charging and testing board can be supplied as illustrated in Fig. 2. This includes a voltmeter for measuring the voltage applied to the instrument, a regulating rheostat for adjusting this voltage, a switch for throwing the cell on charge or on the instrument, and lamps for controlling the charging current.

The scale of the magnet tester is graduated in arbitrary units up to 100 divisions and by using a definite voltage, readings on this scale are made comparative not only at one time but for tests made at different times.

The Limitator.

A device for limiting the current demand on metered customers or for use

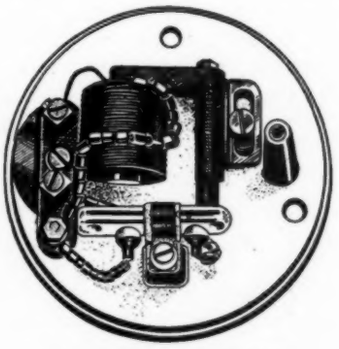


DIAGRAM OF LIMITATOR.

as a flat-rate controller is illustrated herewith. The apparatus prevents the customer using more than a certain amount of current by causing the light to flicker rapidly as soon as any excess load is turned on. The device consists of a small horizontal vacuum tube containing two mercury cups on the lower side, with leading-in wires sealed into the glass and making contact with a globule of mercury in each cup. A soft-iron bar or needle rests on the globules of mercury and normally completes the electrical circuit between the two leading-in wires. Above one end of the needle is a small electromagnet in series with one mercury cup. The height of the magnet above the needle is adjusted by a set screw and slot in its frame. The instrument is placed in one leg of the circuit, the current passing first through the magnet, then to the left-hand mercury cup through the needle to the right-hand cup, and

thence to the load. The action is as follows: When the load exceeds the predetermined limit the magnet lifts the needle away from the mercury cup and breaks the circuit. This interrupts the current in the magnet, which allows the needle to drop back in the cup and the cycle is repeated, producing a continuous flickering of the lights as long as the excess load is maintained. The adjustment for different limits is made by simply raising or lowering the magnet until the lights remain steady on the desired load, but will flicker if another lamp is added. When this adjustment is once made it will remain accurate to within a few watts indefinitely.

The size illustrated can be adjusted for loads up to three amperes. For currents of from three to ten amperes an instrument of similar design is used in which the needle is omitted and a horizontal column of mercury completes the circuit. When an excess load is applied the magnet in the larger type tilts up the tube and the mercury runs down to one end, thereby breaking the circuit for an instant until the tube is dropped to the horizontal position again. With this size the lights go out and light alternately, keeping up this operation indefinitely. It is therefore possible to use the "Limitator" for blink electric signs.

It can be used on either direct or alternating currents of any ordinary lighting voltage without special adjustment.

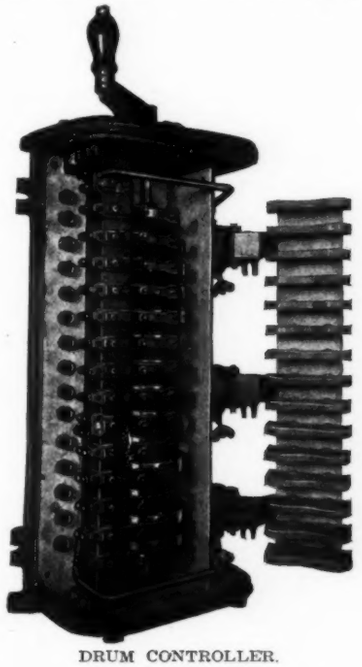
The Southern Engineering Corporation, Gunther Building, Baltimore, handles this device for the manufacturer.

New Type of Drum Controller.

The accompanying illustration shows the interior view of the new drum controllers recently designed by the Cutler-Hammer Manufacturing Company, of Milwaukee. These controllers are particularly adapted for use in connection with any reversible motor (series, series-shunt, compound or shunt) operating heavy machinery such as is found in steel mills, as ladle cranes, ore bridges, foundry cranes, ore unloaders, car dumpers, transfer cranes, etc. They are also adapted for all types of hoisting machinery which requires frequent starting and stopping. Speed variation is obtained by means of resistance in the armature circuit.

These controllers are inclosed in a cast-iron weatherproof shell and have removable head and cover. The copper segments are mounted on a rotating cylinder and a special impregnated maple finger-board carries a suitable number of fingers for making and for breaking circuits supplying current to the motor armature for either direction and also for cutting out the starting resistance in a large number of steps, to produce smooth and easy acceleration. The entire finger-board can be removed without removing the cylinder.

Full-reversing and dynamic-lowering types of controllers are included in this new line. With the latter type in many cases the speed of a descending load



DRUM CONTROLLER.

can be reduced to such a degree that its downward movement is not perceptible to the eye.

The principal features claimed for these controllers are: ease of operation permitting the operator to feel all the points of control; even distributing of magnetic flux, obtaining effective blowout on each finger and segment; hinged pole piece, increasing accessibility; newly designed non-stubbing fingers; large number of resistence steps; and arrangement of circuits. All segments and fingers have renewable tips.

These controllers are made in four types: A, B, C and D, in capacities of 50, 100, 200 and 400 amperes and for 6, 7, 8 and 9 speeds each way, respectively. Standard sizes are made for use with 110-volt, 220-volt and 500-volt direct-current motors.

A New Process of Water-softening.

It is probable that few people, if asked to describe the nature of "zeolites" could do so. Briefly, they are hydrated silicates of alkalies, generally with silicates of aluminum, and seldom containing magnesium. The water is, we believe, generally regarded as basic, in union with silica.

These zeolites have, in contradistinction to other silicates occurring in nature, the property of being soluble, and they also decompose in dilute acids. They have also the very important property of being able to exchange their bases for others.

Having said this much with regard to the zeolites found in nature, we come to the connection which the property they possess of exchanging their bases for others has with the subject of our article. One would not, on first thought, see much connection between zeolites and the softening of water, but it has been found that when hard water is allowed to filter slowly through layers of these hydrated silicates of alkalies the lime in the water changes place with the soda in the filtering medium, and the water passes out softened; and this fact has been the means in Germany of instigating a series of experiments during the last two years, which have proved of great value, and which have shown that these zeolites can be produced artificially, with the result that the substance is now made much more regular in its composition and freer from impurities than that found in a state of nature. To these artificial zeolites has been given the name of "permutit," which in a moist condition is of a granular flaky form, and has a luster like that of mother-of-pearl. It has a high porosity, and in the dry state readily absorbs about 50 per cent of water. The details of its manufacture cannot be gone into here, but we may say that it is obtained by fusing together felspar, kaolin, clay, and soda in definite proportions, the resultant material being lixiviated with hot water, which permutit is left as a residue. The granular material is freed as much as possible from the final alkaline lye by washing and centrifugal action. The empirical formula of an artificial zeolite is approximately 2 SiO_2, Al_2O_3, Na_2O, 6 H_2O.

Now the use of this material for softening water may be briefly described

as follows: As is well known, the total hardness of water may consist of temporary hardness or of permanent hardness, or of the two combined, the former being caused by calcium and magnesium carbonates, and the latter by other salts of lime and magnesia. Boiling at atmospheric pressure precipitates the carbonates and the magnesia, but not the salts forming permanent hardness. Now, as is well known, in the commercial processes at the present time, solium carbonate is added to water as a means of precipitating the hardening constituents of the water, there being an exchange of bases between the lime and manganese and the sodium carbonate. In like manner, if hard water be allowed to filter slowly (the slower the better) through layers of permutit, there is likewise an exchange of bases, the lime in the water taking the place of the soda in the permutit, one molecule of calcium bicarbonate being converted (in the case of temporary hardness) into two molecules of sodium bicarbonate, which latter remains in the water, being very soluble.

The question that will, of course, at once arise in the mind is, how long will the permutit in the filter retain this power? The answer is that it will only retain it so long as any soda remains to exchange with the lime in the water, and here really comes the most interesting part of the process. Permutit suffers practically no loss during use, but when a certain amount of water has been passed through it, its softening powers disappear, but they can easily be restored, and the material can be used over and over again practically indefinitely.

The power of regeneration appears to be the chief novelty of the process; but before it is carried out a few essential points must be attended to. In the first place, the filter must be cleaned. Experience shows that filtration is most effective from the top to the bottom, and that, therefore, cleaning should take place in the reverse direction—namely, from the bottom to the top—so as to loosen the mass and remove any air that has collected in the material, soft water, if possible, being used for the purpose. After washing, the permutit is regenerated by a solution of common salt, the solution generally being of ten-per-cent strength. Previous to regeneration all water is removed from the filter down to the layer of permutit, after which the salt solution is introduced and allowed to flow slowly through the filter for from four to five hours. In addition to this, the brine is allowed to stand for a further four or five hours, just covering the layer of permutit, after which the filter is filled with water from the top, and an outlet cock at the bottom is opened for twenty or thirty minutes, or until the water no longer shows any hardness, with ammonium oxalate or with soap solution.

The chemical reaction that takes place during regeneration consists in an interchange between the soda in the sodium chloride and the lime in the permutit (derived from the water which it has softened), calcium chloride remaining in solution in the regeneration water. It may be stated that in practice the most suitable rate for the water that requires softening to pass through the layers of permutit has been found to be from 13 to 17 feet per hour.

From information supplied from Germany it appears that filters using these artificial zeolites have been in practical use during the last two years, treating water for a variety of purpose, including use in boilers and for washing fine textile goods, and a plant has recently been installed in England for the latter purpose. The results, so far as we are able to gather, have been entirely satisfactory. The treated water is, we understand, particularly well adapted for textile industries, as it can be reduced in hardness practically to zero. In one case where a permutit filter was supplied to a steam laundry in Berlin more than two years ago, it is stated that in about nine months, 1,174,800 gallons of water passed through the filter, which volume was completely softened without any apparent loss of permutit. The charge of permutit was about half-a-ton, and about 1,050 gallons of water passed over each pound of the material. In this case about 44,000 gallons of water per week were used, and regeneration was carried out twice per week, eighty-eight pounds of salt being used per regeneration, although it is stated that it need not have been done quite so often. It is stated that water having fifty-three degrees of hardness has been reduced to 3.7 degrees by the process.—*Engineering.*

Electric Organ Blowers.

A profitable side line for electric contractors is the installation of electric blowers for church organs. The old fashioned water motor is almost a thing of the past, quite as much so as pumping an organ by "boy power."

The Kinetic Engineering Company, whose western office is located at 1445 Monadnock Block, Chicago, makes a blower—the Kinetic—which has been adopted by most of the American organ builders for their new organs, and many of them are being sold to be applied to old organs, replacing water motors.

The blower is a special development of the centrifugal fan, and consists of

KINETIC ORGAN BLOWER.

a wooden box or casing, containing several fans, keyed to a shaft, the rotation of which develops a pressure, each fan handling the air in turn in series, until the air has passed through all the fans and the pressure required by the organ is reached.

The blower, except in very large sizes, has a direct-connected motor, and a valuable feature is that this system is the only one that operates equally well with alternating current as well as with direct current. Most methods of blowing an organ by an alternating-current motor require belt shifting or belt tightening devices, which are clumsy and very often quite unsatisfactory.

The company issues a booklet which, besides describing the blower, gives interesting information and pictures about primitive organs and especially the method of blowing them.

Indicating the Charge of an Electric-Vehicle Battery by Means of a Pilot Cell.

The most important and, as a rule, the first questions that are asked by the purchaser of an electric vehicle are, "How am I to know how much electricity there is in my battery?" When the vehicle has been left at a garage, how can I tell that the right amount, or that any electricity has been put into the battery?"

It has been necessary heretofore to give evasive and unsatisfactory answers to these questions, in order to avoid a discussion of one of the most annoying features of the electric vehicle, namely, the difficulty of knowing at any time how much work the vehicle is capable of doing before recharging is necessary. This uncertainty with regard to the amount of charge in the battery causes the operator at one time to waste time and electrical energy in charging the battery, when charging is unnecessary and harmful, and at another time to undertake to do a certain amount of work with an insufficient supply of energy, the result being not only failure to do the work, but an additional expense incurred for towing the vehicle to a charging station. The difficulty of ascertaining at any and all times the condition of the charge in the battery has done more, it is safe to say, to retard the general introduction of the electric vehicle than any other defects, either of batteries, motors, or method of operation. There is, however, no difficulty ordinarily in telling the state of charge of a lead storage battery from a knowledge of the specific gravity of its electrolyte.

When the surface of the battery solution is open to inspection the readings of a hydrometer floating in the solution will indicate exactly, not only when the battery is fully charged, but also what proportion of a full charge there is in it at that time. In fact, the specific gravity is a very much more reliable indication of this than the voltage, color of plates, amount of gassing or other rough guide. It is independent of whether the battery is idle or is being charged or discharged, and also independent of the current passing.

In electric vehicles, however, the batteries are usually located in places that are difficult of access and as the covers of the rubber jars are sealed down close to the surface of the battery solution, it is necessary in order to use a hydrometer, to draw off a certain quantity of the acid and to test its specific gravity in a separate vessel. As it is obviously impracticable to perform this operation every time that it is desirable to know the condition of the battery, when the actual condition of the battery has to be determined, it is usual for battery manufacturers to recommend that a hydrometer reading of the battery be taken about once a week as a check on more convenient but less reliable methods of operation that may be used from day to day. These recommendations, however, are often entirely disregarded on account of the inconvenience of putting them into practice, and in probably ninety-five per cent of the cases in which there is dissatisfaction with the operation of an electric vehicle, it will be found that the battery has been neglected this way.

To render it convenient at all times more convenient methods, such as by means of a voltmeter, are usually adopted for estimating the state of charge of the battery. For practical purposes these methods, as a rule, are sufficiently reliable as long as the apparatus is new and in good working order, but the indications obtained from them become misleading and worse than useless when anything happens to be wrong either with the battery or the measuring instruments.

For this reason, and because it is always necessary to use a hydrometer

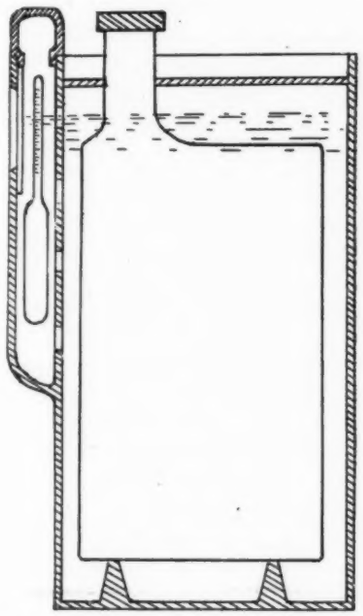


FIG. 1—SCHEME OF MACRAE PILOT CELL.

FIG. 2—APPLICATION OF PILOT CELL TO STORAGE BATTERY OF AN ELECTRIC VEHICLE.

to ascertain the condition of the battery by means of the hydrometer, the pilot cell shown in the accompanying illustrations has recently been invented and patented by R. Macrae, of Chicago. As will be seen from Fig. 1, this consists of an ordinary rubber battery jar provided with a hydrometer pocket, the liquid in this pocket communicating with the liquid in the cell through holes in the separating wall of the jar. This hydrometer compartment is provided with a small glass window through which the readings of the hydrometer can be observed. A suitable guide below the surface of the liquid keeps the stem of the hydrometer central with regard to the glass and prevents the hydrometer from sticking to the sides of the compartment.

Fig. 2 shows the manner in which the pilot cell is used on an ordinary pleasure vehicle. Here the upper strip of the battery tray is cut in two pieces which are united by a perforated wooden block through which the hydrometer can be read.

A small card attached to the battery box shows the number of miles that should be obtained from the vehicle for different readings of the hydrometer when the vehicle is in good running order and is operated on well paved streets. The card for this particular car is shown in Fig. 3. A little experience will soon enable the operator to make proper allowances for unusual running conditions, such as bad roads, frequent stops, etc. When the performance of the vehicle falls below what the card calls for, it is an indication that either the vehicle or the battery needs attention, and this attention should be given without delay.

One of the most valuable qualities of a hydrometer is that when it has once been accurately calibrated it always remains accurate. This is not the case with instruments having moving parts, jewel bearings, and permanent magnets, especially when these instruments are more or less exposed to the weather and are subjected to the joltings of an electric vehicle.

It often happens that when these instruments indicate that there is trouble in the vehicle or in the battery that the trouble is found to be in the instruments themselves. Being the most delicate part of the outfit, constant care is required to keep them in such condition that their readings can be relied upon. No such care, however, is necessary when a hydrometer is used, and there is never any question in regard to the accuracy of the readings. Even when in perfect condition, the readings of a voltmeter, especially on open circuit, are misleading to one who is not a storage-battery expert.

When the hydrometer indicates that the specific gravity of the battery is up to what should be its highest point, it is quite certain that the battery is fully charged, and when, on the other hand, the hydrometer reading is low, it is equally certain that the vehicle will not give its full mileage no matter what the readings of any other instrument may indicate.

When an electric vehicle is provided with a pilot cell containing a hydrometer, it is possible to give definite instructions for charging that are readily understood and easily followed out. There is no excuse either for injury to the battery by overcharging or poor service due to insufficient charge; irregularities in the running of the vehicle are readily detected and the operator is spared many anxious moments of doubt as to whether or not his supply of electricity is sufficient to carry him to his destination.

MILEAGE ON GOOD STREETS	
Gravity	**Miles**
1280	72
1260	60
1240	42
1220	36
1200	24
1180	12
1160	0

FIG. 3—CARD SHOWING MILEAGE AVAILABLE.

The specific gravity of vehicle batteries has commonly been determined by means of syringe-type hydrometers provided with a bulb for drawing some of the liquid up into a glass tube in which the hydrometer floats. These are easily broken and troublesome to use. Generally, they are also inaccurately used, because only a small quantity of electrolyte is drawn from the top of the cell and this may not give the average density. The pilot cell, on the contrary, is extremely convenient to read and is therefore accurately read.

The Macrae pilot cell is being manufactured for all the standard types of electric-vehicle batteries by the Eddy Brass Foundry & Machine Company, of 173 North Green Street, Chicago.

New Storage-Battery Cars.

The Electric Storage Battery Company, of Philadelphia, has closed a contract for the battery equipment of the thirty-five new storage-battery cars for The Dry Dock, East Broadway & Battery Railroad Company, of New York City, to be placed in service on its lines during the early summer.

These new cars have been specially designed by the Third Avenue Railway Company to give the necessary strength with minimum weight. Each car is equipped with two motors and the batteries are installed under the longitudinal seats.

The cars will give a maximum speed of 15 miles an hour on level track, with a schedule speed of 7 to 8 miles an hour, including stops. They are of the open-platform, single-truck type with eighteen-foot car bodies.

The battery equipment of each car consists of fifty-eight cells of type 29 MV Hycap-Exide. Cells of this type have been operated in street-car service in New York for nearly a year with marked success.

Re-Chargeable Dry Battery.

A new electric dry battery, now being introduced in England, is claimed to have a useful life of up to three and one-half years, and as the deterioration when it is not in use is negligible it will retain its charge for several years. It may be re-charged several times, in the same way as a storage battery. For the negative element a number of zinc plates are employed, and for the positive element a carbon rod is embedded in a composition formed of charcoal and manganese oxide, surrounded by a mixture of ammonium chloride, chloride of lime, and zinc chloride. These elements are placed in an electrolyte consisting of amylon, obtained from the sago palm with exciting salts composed of platinum-ammonium chloride and zinc-ammonium chloride. This electrolyote, which is in the form of a jelly, is claimed to retain its moisture for long periods and to be but little affected by variations of temperature.

Current Electrical News

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., JUNE 1.—Surveys are being made on the Bavispe River near Angostura for one of the largest irrigation and hydroelectric enterprises on the continent. The Richardson Construction Company, of Los Angeles, Cal., in which John Hays Hammond, the well-known mining engineer, is largely interested, is promoting the project. The preliminary surveys for the proposed dam and irrigation system were begun about three years ago under the personal direction of Mr. Hammond, who visited the Yaqui and Bavispe valleys and went over the ground with the view of determining the possibilities of the irrigation proposition. Since then several sites have been investigated, but it has been finally determined to locate the main dam at a point on the Bavispe River near here, at a point where the mountains form a narrow gorge not more than one hundred feet wide and rising to perpendicular height of about two hundred feet. The dam will be about 180 feet high and will form a water storage reservoir of enormous capacity.

The proposed hydroelectric plant that forms a part of the plans of the company will be of large capacity and will provide sufficient power to operate the machinery of mines and other industries in a wide scope of territory of the states of Sonora, Sinaloa and the western part of Chihuahua. The company owns great tracts of land in the valleys of the Yaqui and Bavispe Rivers which will be embraced in the big irrigation canal system. The Bavispe River is the principal tributary of the Yaqui and it is assured that there will never be any lack of ample water supply for all purposes.

The surveys for the proposed hydroelectric plant that is to be installed on the Balsas River near Balsas by the Balsas Power & Irrigation Company are being made, and in a short time the plans for the big project will have advanced to that point when construction work can be started. It is stated that practically all of the stock of this company is held in Germany and that it is entirely separate from the hydroelectric project that is said to be under consideration by the Canadian syndicate that is headed by William Mackenzie, of Toronto. The latter contemplate also using the water of the Balsas River to generate electric power. The plant of the Balsas River & Irrigation Company will have a minimum capacity of 40,000 horsepower. The proposed works involve the construction of a large dam across the Balsas River, and when it is desired to enlarge the capacity of the plant other dams will be built. Representatives of the company have made a canvass of the territory within a radius of sixty-five miles of the site of the proposed plant and an estimate is made that the mining companies, towns and industrial concerns generally within that radius will use not less than 28,000 horsepower from the proposed plant. By extending the transmission lines to the 100 to 150-mile radius a market will be found for the whole 40,000 horsepower or more, it is claimed. Even the City of Mexico, Pueblo and other large cities are within range of the proposed transmission system of the company. A. B. Adams, Inc., of the City of Mexico, conceived the big project and is said to have been largely instrumental in interesting German capital in its feasibility from an investment standpoint.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, CAN., JUNE 1.—Plans for the construction of an immense dam, at the foot of the Coteau Rapids, in the St. Lawrence River, are now under consideration by a special commission of government engineers. The Canadian Light & Power Company of Montreal is promoting the big development scheme.

Another addition to the list of power companies in Ontario has been announced in the official gazette of the province. This is the incorporation of the Eastern Power Company with a capital of $500,000. The company will construct a power plant on the Trent River, and will probably be a subsidiary company of the Electrical Power Company which already has a string of power plants on the river.

The Calgary Power Company, of which Montreal capitalists are the controlling interests, has just issued its first annual report. Construction work is about completed, and power will shortly be delivered at Exshaw and Calgary. The company intends issuing a further $350,000 of bonds, to be expended in creating storage reservoirs, a railway spur, etc. The property account is valued at $2,798,926.

Hon. Adam Beck, chairman of the Ontario Hydro-Electric Commission, speaking on the question of cheap power, stated that the contract which the Commission has made with the New York & Ontario Power Company, was at a lower rate than for Niagara Power. Owing to the fact that the Ontario Government could not build apparatus outside of the province, it was necessary to have the company at Waddington, N. Y., reduce the power to the required voltage. The company's figure for a minimum of 2,000 horsepower is $13.00 while for 10,000 horsepower it is $11.00.

The balance sheet of the Electrical Development Company, for the year ending December 31, 1910, is interesting in view of the reports of a merger. The company has invested $12,630,000 in its plant, and $3,590,000 in its transmission lines between Niagara Falls and Toronto. It is pointed out that expensive underground work has been completed for eleven units, and above ground work for practically seven units, whilst only four units are delivering power and earning bond interest. It is said that three more units can be installed at an expenditure of $600,000. To deliver 50,000 horsepower has cost $10,000,000; to deliver 40,000 additional horsepower would cost only $600,000.

It is now announced that the plans of the Hydro-Electric Commission for carrying its cheap power project into central Ottawa Valley are fairly well matured. One proposition is to acquire control of the Chats Falls, on the Ottawa River, thirty miles from this city. A power plant is to be constructed there, and transmission lines are to be run to Ottawa and to several leading industrial towns of the Ottawa Valley. The Falls are owned by William Harty, M. P.

The incorporation of the National Hydroelectric Company, of Montreal, with a capital of $1,000,000, makes one more electrical company which will seek a market in Montreal. Henry Miles is the president of the new corporation and Louis Gosselin is the secretary. The Carillon Falls, on the Ottawa River, thirty-five miles from Montreal, will be the source of the power. The surveyors for the Georgian Bay Canal considered that 148,000 horsepower could be developed at this point. At present about 33,000 horsepower will be developed.

The incorporation by a number of Montreal capitalists of the Prince Rupert Hydroelectric Company, with an authorized capital of $5,000,000, and a bond issue of $3,000,000, introduces a new industry on the Pacific Coast. It is figured out by the promoters that within a year, Prince Rupert, the new terminus of the Grand Trunk Pacific railway on the Pacific Coast, will have a population of 12,000, and that it will thereafter grow rapidly into a big city. It is claimed that within a few years such a plant as that now in course of construction will pay handsome dividends. It is estimated that the water powers, which are located about forty-two miles from Prince Rupert, are capable of developing at least 30,000 horsepower of electrical energy. It is expected that the stock of the new concern will be taken up immediately, the principal portion of it going into the Canadian group of capitalists who have been identified with electrical developments in Mexico.

IMPORTANT DEVELOPMENT.

(Special Correspondence.)

HYDROELECTRIC POWER FOR AUSTIN, TEX.—After an agitation covering a period of several months and in response to a public invitation on the part of the City Council of Austin, Tex., two propositions were formally submitted to that body June 1 for the reconstruction of the large dam across the Colorado River near Austin and the installation of a hydroelectric plant. The propositions were taken under consideration by the Council and a citizens' advisory committee and whichever one is deemed best will be submitted to a vote of the people of Austin. A decision as to the propositions will not be rendered until about June 15, it is stated. One of the pending propositions was made by the J. F. Cogan Company of New York and the other by the Hydraulic Properties Company of New York. The J. F. Cogan Company offers to build a hollow concrete dam sixty feet above low water, utilizing the part of the old dam that remains intact. It agrees to install four 1,000-horsepower alternating or direct-current generators; four 1,000-horsepower turbines; to construct a 10,000,000-gallon reservoir near the site of the dam and install two 60,000,000-gallon-a-day centrifugal pumps to keep the reservoir filled. The company reserves the right to use all the salvage left from the old plant. It guarantees a minimum of 1,000 horsepower of electrical energy, all power generated to belong to the city. It agrees to operate the plant for a period of twenty years and guarantees to repair all damages that may occur from time to time. It agrees to begin work within thirty days after the granting of the franchise and to have the dam and hydroelectric plant finished and in operation within two years. The cost of the works is to be $1,250,000.

The Hydraulic Properties Company, through its president, William D. Johnson, of Hartford, Conn., proposes to build a dam of hollow-concrete construction, to be not less than sixty-five feet high. It will begin work within sixty days from the granting of the franchise and finish the dam within two years. The company agrees to operate the plant for a term of twenty-six years and to indemnify

the city for all loss by leakage, etc., unless caused by earthquake. In case of breakage of the dam the city is to be absolved from further payments. The company agrees to install three turbines, aggregating not less than 6,400 horsepower, and electrical generators aggregating 6,000 horsepower; to construct a reservoir of 10,000,000 gallons capacity and equip with two pumps of 6,000,000 gallons daily capacity, and to maintain a constant supply of not less than 5,000,000 gallons in the reservoir. It guarantees to have expended $25,000 within seven months and that the work shall be continuous. It will furnish 450,000 kilowatt-hours of energy monthly to the city without cost; all above that to be the property of the company, but it is stipulated that it shall not dispose of it outside of Austin. The works under this proposition are to cost $1,400,000. D.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

John T. Carlisle, who was commissioned by Governor Dix to investigate the work of the Public Service Commission of the First District, has reported favorably on it in every way. He further condemned the proposal for the consolidation of the two Public Service Commissions and also the suggestion for the re-establishment of a Rapid Transit Commission appointed by the municipal authorities. His report expressed the opinion that public officials should determine the routes of new subways without consulting the companies that would presumably operate them, and that thereby the delays caused by the present system would be largely avoided. Mr. Carlisle begins his report by pointing out that he publicly invited all persons having any grievance against the Public Service Commission in New York City to appear at a hearing in the Engineering Societies Building on April 4. No one responded. Then he entered on a personal examination of the Commission, examining employes under oath and conferring with practically all the operating officials of the public service corporations of the city and all persons or associations who wrote to him. It was Mr. Carlisle's opinion that full credit should be given to the Commission for the great works that have been undertaken or in progress in the city more or less under its supervision since July 1, 1907, all of which he believes relieve in some degree the conditions now existing.

Accident statistics for the month of March, 1911, as compiled by the Public Service Commission for the First District show that the total number of accidents on street and electric railroads within the Greater City increased from 4.292 in March, 1910, to 4,574 in March, 1911, an increase of about 6.5 per cent.

While the number killed shows an increase of five over last year, being seventeen for March of this year and twelve for March last year, the total number of serious accidents fell off from 174 in March of last year to 134 in March of this year. The number of passengers injured also shows a decrease from 1,965 in March last year to 1,840 in March of this year.

The revenue car miles increased from 24,697,510 in March of last year to 26,191,000 in March of this year, an increase of a little more than six per cent. The total number of revenue passengers carried increased from 131,760,785 in March of last year to 135,040,000 in March of this year, an increase of about 2.5 per cent.

The Syracuse Lighting Company has been authorized to exercise rights and privileges under franchises granted by the town of Manlius, Onondaga County, and has been granted permission to construct an electric transmission line in that town. The Commission has also authorized the Marion Power Company to issue six-per-cent bonds to the amount of $9,500, the bonds to be sold at not less than par and the proceeds used for the construction of a plant of the company in Marion, Wayne County.

The Public Service Commission, Second District, has approved of the sale, transfer and assignment to the Federal Telephone & Telegraph Company of the franchises held by the Warner Telephone Company, Penn Yan Telephone Company, Wayland Independent Telephone Company, Clifton Springs Telephone Company, Livingston County Telephone Company, Salamanca Telephone & Telegraph Company, which companies operate in the villages of Gowanda, Lima, Dansville, Livonia, Geneseo, Honeoye Falls, Penn Yan and Wayland.

The Public Service Commission, Second District, has granted authority to the Long Island Lighting Company, recently organized for the purpose of taking over several companies on Long Island, to issue a first mortgage upon all its property and franchises, conditioned to secure the payment of its five-per-cent bonds payable twenty-five years from date to the aggregate amount of $6,000,000. The Company is authorized to issue its capital stock to the amount of $300,000 at not less than the par value thereof. The Company is also authorized to issue bonds upon the security of its mortgage to the aggregate amount of $295,000. The proceeds of the stock and bonds are to be used for the purchase of the capital stock and outstanding bonds of the Northport Electric Light Company, Amityville Electric Light Company, Sayville Electric Company, Islip Electric Light Company, for new construction from Northport to Commack, Commack to Islip, Islip to Sayville, and Islip to Babylon, for a low-tension line from Brentwood to Central Islip and Sayville to Ronkonkoma, and also for general improvements in apparatus and overhead construction throughout the entire territory which it covers. The company is also authorized to commence construction of the new transmission lines and other parts of its system.

INTERSTATE COMMERCE COMMISSION NEWS.

(Special Correspondence.)

The Interstate Commerce Commission has decided that as between subscribers to a telephone service who are similarly situated, nothing but a difference in the service rendered or facilities furnished can justify the differences in the charges exacted. That the fact that a few subscribers connected with a new exchange were previously connected with another exchange which was abandoned by a telephone company from motives of economy in management and efficiency of service is not such a dissimilarity of circumstances and conditions as to warrant the exaction of the current charges from a new subscriber while for the same service and facilities the old subscribers continue to pay the lower charges formerly exacted at the old exchange. It was also decided that the contracts between the old subscribers and the defendant company, even though valid when made, can not, after Congress has undertaken to regulate the rates and practices of telephone companies, be accepted as now justifying different charges as between different subscribers similarly situated, such undue discriminations being forbidden by the Act.

The Interstate Commerce Commission has rendered a decision requiring steam railroads to accept traffic from electric roads and this is considered as being an important recognition of the electrically operated lines and will be of special significance in many sections of the country where territory heretofore monopolized by steam railroads as far as freight traffic is concerned will now be utilized for freight as well. The status of the electric road was one point of contention in the discussion of the amendment to the Interstate Commerce law before Congress, and the principle which the Commission has thus set forth was urged at that time as essential to the full utilization of electrically operated franchises as feeders and distributors for the steam railroad systems. F.

LIGHTING AND POWER.

(Special Correspondence.)

BELTON, MO.—This city has voted to construct its own electric light system. P.

CLAYTON, WIS.—The Clayton Electric Company has been incorporated with a capital stock of $2,000. P.

MANKATO, MINN.—The Consumers Power Company will install five cluster column lights on Front Street. C.

BONAPARTE, IOWA.—J. A. Johnson and others are planning the establishment of an electric light plant here. P.

BLANCHARD, IOWA.—Frank Walkinshaw is planning the installation of an electric light plant. C.

FRANKLIN, NEB.—This city has disposed of its electric light bonds and will begin work soon on the new plant.

MT. VERNON, IND.—The City Council has decided to install an ornamental cluster-lighting system in Vincennes. S.

ODELL, NEB.—The Missouri Valley Electric Company has been incorporated with a capital stock of $150,000. P.

AITKIN, MINN.—M. D. Stoner, in charge of the electric light system, is considering the furnishing of power to Aitkin. C.

FAYETTEVILLE, ARK.—The Fayetteville Electric Light & Power Company will enlarge its plant, at a cost of $20,000. P.

BUTTE, MONT.—The Council has authorized the extension of the curb cluster lighting system at an estimated cost of $12,000. C.

SPOONER, WIS.—The Power Engineering Company, Minneapolis, has the contract for improvements to the local electric light plant. C.

TACOMA, WASH.—The Municipal Commission will extend the electric light service to the Narrows, at a cost of from $2,500 to $3,000. C.

LULING, TEX.—The Luling Electric Light & Power Company, of Luling, Texas, will enlarge and otherwise improve its plant here. D.

NEVADA, IOWA.—The Nevada Electric Company is planning to run electric lighting wires to Roland, McCallsburg and Zearing, Iowa. C.

ARCADIA, WIS.—Plans by Vaughn & Meyer, engineers, for the proposed electric light plant have been approved by the village board. C.

NEWTON, IOWA.—The Council has decided to build a new municipal electric light plant to replace the one which was burned recently. C.

NEW IBERIA, LA.—The Southwestern Traction & Power Company, of New Orleans, will erect a power station and car house here. P.

BISHOP, TEX.—The local electric light plant, owned by F. Z. Bishop, will be enlarged. Mr. Bishop also contemplates installing an ice plant. D.

EDGEFIELD, S. C.—At a recent election it was voted to establish a municipal lighting plant, and bonds have been issued to the extent of $15,000.

LENA, ILL.—The Lena Electric Light & Power Company is improving its plant, and installing machinery which will practically double its generating capacity.

PORTLAND, ORE.—The Mount Hood Railway & Power Company will build a line to South Mount Tabor and furnish that locality with current for lighting.

DALLAS CENTER, IOWA.—It has been voted to grant a franchise for the installation of a lighting system to Adel Mill Company, to be operated by November. C.

EXCELSIOR, MINN.—A franchise has been granted to the Belle Plaine Electric Light & Power Company, and an electric light plant will be built at a cost of $12,000. C.

CAMDEN, S. C.—A committee representing the Chamber of Commerce appeared recently before the City Council urging the installation of a municipally operated plant.

COHOES, N. Y.—Work has been started on the erection of a new power electric house for the Harmony Mills. The power plant will be located west of the company's office.

RIVERSIDE, CAL.—The Pacific Light & Power Corporation, through its district manager, C. M. Grow, has been awarded a franchise for an electric distributing system in this city. A.

HONDO, TEX.—The Hondo Light, Power & Ice Company has been formed at Hondo, Tex., with a capital stock of $24,000. The incorporators are J. H. Horn, Louis Schlentz and Jacob Fohn. D.

MENASHA, WIS.—It is probable that the Northern Hydro-Electric Company, of High Falls, Wis., will be awarded the contract to operate the lighting plant which is to be installed by the city.

BARABOO, WIS.—The gas and electric plants of the Baraboo Lighting Company were sold at auction to the bond holders of the company for $60,000. It is probable that day service will be established.

ADAMS CENTER, N. Y.—The Chaumont Electric Light Company has been incorporated with a capital of $8,000 by Edgar H. Merriman, of Adams Center, and Charles N. Arnold and George Diefendorf, of Chaumont.

IMPERIAL, CAL.—The Board of Trustees of this city has published its intention to contract for electric current for lighting the streets and for house lighting in this city, as well as for poles, wire, lamps and other appliances. A.

CENTRALIA, WASH.—The Centralia Electric Light & Traction Company was incorporated with a capital of $500,000. The incorporators are: N. W. Mills, Daniel Salzer, Walter Copping, G. W. Much and W. B. Richards.

NANTY GLO, PA.—I. Stanton Davis and Walter Jones have secured the controlling interest in the Jackson Light Company, which operates here. Officers of the company are: T. P. Burns, president, and Walter Jones, secretary.

DECATUR, ALA.—This city is considering the construction of a municipal light plant and has plans submitted calling for an expenditure of $40,000. The plans and estimates were made by the J. B. McCreary Company, of Atlanta, Ga.

BRAINERD, MINN.—The Northwestern Electric Equipment Company was awarded the contract to furnish equipment for electric street lighting in Brainerd. The water and light board awarded the contract on the company's bid of $3,080.

FRESNO, CAL.—A power plant is being considered for the group of county buildings here. This group includes the court house, hospital, orphanage, and almshouse. An estimate of cost has already been made by Fairbanks, Morse & Company.

FRANCIS, TEX.—The Francis Light & Power Company has been formed here with a capital stock of $10,000. The incorporators are A. L. Mullwergen and W. J. Donathan, of Poteau, and W. P. Chism, Albert Goetter and W. L. Shaffer, of Francis. D.

ELKO, NEV.—The Merchants' Light & Power Company has been incorporated with a capital of $500,000 by M. S. Browning, A. L. Brewer, J. S. Lewis and others. The company was recently awarded a contract for furnishing Ogden City with light.

STONE HARBOR, PA.—This village will have an electric light plant installed before the end of June and will supply lights to the cottages here. The Stone Harbor Electric Light & Power Company which was recently incorporated is carrying on the work.

HAMPTON, VA.—Contracts for lighting the streets of Hampton have been awarded to the Newport News & Old Point Railway & Electric Company and the Hampton, Phoebus & Fort Monroe Gas Corporation. Business is to be divided between the two companies.

SAN FRANCISCO, CAL.—Architect Willis Polk of this city is preparing plans for a reinforced concrete power station to be erected for the San Francisco Gas & Electric Company on Bush Street near Larkin, at a cost of $15,000. The building will be used as a substation. A.

PEORIA, ILL.—The Peoria Gas & Electric Company has been awarded a franchise in Washington, Ill., and is building a new pole line in that city. The old plant in the city of Washington burned down and will not be built up again, as the Peoria Company will transmit power from the plant here at 4,000 volts. V.

TUCSON, ARIZ.—The Great Western Power Company has begun the preliminary work towards the installation of a large hydroelectric plant near here. A road is now being constructed to the site of the proposed dam. The latter structure will be 360 feet high and will form a storage reservoir for an enormous supply of water for operating the hydroelectric plant. D.

GREAT FALLS, MONT.—The Great Falls Townsite & Power Company will expend $4,000,000 for the development of the Rainbow Falls power site; $4,000,000 in the construction of a power plant at the Great Falls of the Missouri and $7,000,000 in the electrification of 120 miles of road to be built to Lewiston.

MOSS BEACH, CAL.—The Half Moon Bay Light & Power Company has been incorporated here with a capital stock of $25,000, of which $12,500 has been subscribed by J. J. Gomes, M. Codivo, Ben Cunha, J. Fernandez and F. N. Staley. The company will supply light to various towns about and near Half Moon Bay. A.

NEVADA, IOWA.—Officials of the Nevada Electric Company are negotiating with local business men regarding the running of a line from the plant here to McCallsburg and thence east and west to Zearing and Roland and supplying electricity for light and power for those places.

HAZLETON, IND.—The Consolidated Light & Power Company has filed articles of incorporation. The initial capital stock is $15,000. The object and purposes of this corporation are to supply the towns of Hazleton and Patoka and the surrounding communities with electric light and power. Ethelbert Curtner, Jesse D. Doty and James F. Breithaupt are directors. S.

VULCAN, MICH.—Wisconsin and upper Michigan capitalists have organized the Peninsula Power Company and will shortly undertake to harness the Twin Falls of the Menominee River a few miles distant from Iron Mountain. The improvements contemplate the expenditure of several hundred thousand dollars. The falls will develop, it is estimated, between 6,000 and 8,000 horsepower.

BODIE, CAL.—The plant of the Pacific Hydro-Electric Power Company at Mono Lake has been completely restored and power is again being furnished cities of southern Nevada. This plant was destroyed last March by snowslides, which tore away the power plant and lines. The plant supplies power and light to Bodie, Lucky Boy, Aurora, Rawhide, Fairview and other camps in Nevada.

VANCOUVER, WASH.—The Washington Engineering & Securities Company has been incorporated here with an authorized capital stock of $3,500,000. The company is understood to be under the same control as the Pacific Light & Power Company and the Electric Bond & Share Company of New York. It is authorized to engage in the distribution of light and power and to operate electric transportation lines. A.

MUNCIE, IND.—The Muncie Electric Light Company has filed notice of the merger of its electric interests in Muncie, Hartford City, Dunkirk, Redkey and Eaton and announces that the name of the corporation will continue to be the Muncie Electric Light Company. The capital stock is given as $1,000,000, and the following are named as directors: H. L. Finley, F. P. Hunter, M. B. Smythe, F. W. Drager, A. H. Melton, W. J. Jeffers and F. B. Kiel.

NEW CASTLE, PA.—The controlling interest in the Mahoning and Shenango Railway & Light Company, operating the traction and light companies of the Mahoning and Shenango Valleys in Pennsylvania and Ohio, including street railway lines in Warren, Youngstown, Niles, New Castle, Sharon, South Sharon and other places in the territory referred to, has been bought by Harrison Williams, representing the General Electric Company. The majority stock, owned by Myron T. Herrick and James Parmlee of Cleveland, and a few others, has been secured by the new owners.

DAYTON, O.—There is a promise of some important litigation involving the franchise of the Dayton Citizens' Electric Company. The franchise was granted May 4, 1906, and a $100,000 bond filed guaranteeing that the company would not merge with any other company for five years. The time expired a short time ago and the company has since merged with the Dayton Lighting Company and the Hills & Dales Electric Railroad Company, forming a $20,000,000 concern. The city solicitor asserts that the merger was effected before the time limit had expired, and that he will bring suit on the bond, and also to forfeit the franchise of the Dayton Citizens Electric Company. H.

MEDFORD, ORE.—The Siskiyou Light & Power Company has completed its surveys for a power line between its power plant at Fall Creek and this city, and will at once begin the work of clearing a seventy-five-foot right of way. The line will be twenty-three miles long, suspended on wooden towers, ten towers to the mile. It will be fitted to carry 60,000 volts. The first cost will be $50,000, with incidental expenses of $25,000 more. When completed, the line will tie into five different plants operated by subsidiary companies.

FRESNO, CAL.—Manager A. G. Wishon of the San Joaquin Light & Power Company states that the company will extend its transmission lines from Madera to Los Banos, Gustine, Dos Palos, Mendota and Firebaugh on the west side of the San Joaquin River, work to begin about July 1. The company now has under construction the following: A line from a point near Clovis to Bakersfield; from Merced to LeGrand and Planada; from Corcoran to Angeoal, Salida and Stohl; and from Corcoran to Bena Vista. Substations are under construction at copper mines near Clovis, Caruthers and Henrietta, and a temporary power plant is being put in on the Tule River to furnish power for the construction of three and one-half miles of tunnel work. A.

ELECTRIC RAILWAYS.

(Special Correspondence.)

HASTINGS, MINN.—The Interurban Construction Company has been organized to build an electric railway to Rochester. C.

BERKELEY, CAL.—The Oakland Traction Company will start at once on double-tracking of its Northbrae line. A.

MARSHALL, TEX.—The new extension of the Marshall Traction Company has been opened up, and regular service commenced.

BILLINGS, MONT.—A franchise has been granted to the Billings Traction Company for the construction of an electric railway. C.

MINNEAPOLIS, MINN.—The Electric Short Line has decided to operate its lines to Medicine Lake by electricity instead of gasoline. C.

HOPEVILLE, IOWA.—The construction of an interurban road to Osceola is projected by the Osceola & Southwestern Railway Company. C.

NORTH YAKIMA, WASH.—The Yakima Valley Transportation Company has begun work on its suburban line from this city to Moxee City. A.

RED WING, MINN.—An ordinance has been drawn granting a franchise to the St. Paul Promotion Railway Company to construct an electric railway. C.

SIOUX FALLS, S. D.—The Sioux Falls & Southern Minnesota Traction Company has been incorporated to build an electric line from Sioux Falls to Albert Lea. C.

MODESTO, CAL.—Material has arrived for the Tidewater & Southern Railroad Company, which is building an electric line from Stockton to Merced, passing through this city. A.

CHIPPEWA FALLS, WIS.—The Twin City Rapid Transit Company is purchasing flowage rights at Eagle Rapids, eight miles from here, with a view to developing 20,000 horsepower. C.

FAYETTEVILLE, N. C.—Following a contest before the town council permission has been granted the Fayetteville Traction & Power Company to extend its lines through Haymount along Hay Street. L.

LADOGA, IND.—Meetings are being held to further a plan to build an electric road from this city to Macey to connect with the Ben Hur road. The farmers along the line are very anxious for the road. S.

MODESTO, ILL.—A contract has been awarded to construct an interurban road between Quincy and Pittsfield. The promotors state that the line will be continued through Modesto to Virden and on to Taylorville.

FT. WAYNE, IND.—The Ft. Wayne & Northern Indiana Traction Company has taken over the Wabash-Warsaw property rights for a line projected by J. A. Barry. The purchasers decline to state how soon work will begin on the projected road. S.

SAN FRANCISCO, CAL.—The Petaluma & Santa Rosa Railway is arranging to build an extension of its lines from Petaluma southward to the San Francisco Bay, with its terminal at McNears Point. The extension will be twenty-five miles in length. A.

EMPORIA, KANS.—The plant of the Emporia Street Railway & Light Company has been mortgaged for $250,000 to a Cleveland, O., bank. The company, with the money received, will build about four miles of new track and will also make other improvements.

ANAHEIM, CAL.—The Pacific Electric Company, of Los Angeles, will build an extension to Fullerton and Placentia, and will connect with the Riverside line at Olinda. South from Anaheim a line will be built to connect with the Santa Ana-Los Angeles line. A.

HOUSTON, TEX.—Announcement has been made that the work of closing the gaps on the Galveston-Houston interurban between Houston and Harrisburg, and near Galveston will soon be completed. This will give an uninterrupted stretch of line between Galveston and Houston.

STOCKTON, CAL.—The Joaquin Delta Railway Company has been incorporated with a capital stock of $500,000, of which $40,000 has been subscribed by E. W. and L. H. Woods, Frank West and E. L. Wilhoit of this city, and W. P. Plumer, I. L. Borden and M. E. Cerf, of San Francisco. A.

FT. WAYNE, IND.—It is reported that the ultimate object of the recently reorganized Ft. Wayne and Northern Indiana Traction Company is to parallel the Wabash Railroad from Ft. Wayne to St. Louis and thence north to Toledo. Nearly half of the distance is already built and the lines in operation. S.

INDIANAPOLIS, IND.—The Indianapolis, Nashville & Southern Indiana Traction Company is asking the Commissioners of Marion County for a right of way to build a traction line through the county. John A. Johnson, president of the company, says that work of constructing the road from Indianapolis to French Lick will soon begin. S.

FREMONT, O.—If present plans are carried out this city will soon have a combination steam and electric railway station. Negotiations are under way by the Lake Shore Electric, the Fostoria & Fremont Electric, and the Wheeling & Lake Erie for the building of a station at the corner of Front and State Streets in the heart of the city. H.

SPRINGFIELD, O.—It is estimated that it will cost the Ohio Electric Railway Company from $200,000 to $300,000 to complete its air line between this city and Dayton. Work is now well under way. A number of bad curves are being eliminated, and expensive bridges being built. Several gangs of workmen are now engaged in making the improvements. H.

CHARLOTTE, N. C.—Paul Chatham for the Charlotte Rapid Transit Company, has awarded the contract for the construction of the line of the company from the present terminus of the Elizabeth line to the Mecklenburg County Club to W. J. Oliver & Company, of Knoxville, Tenn. The cost of the work will amount to between $35,000 and $45,000.

CHARLOTTE, N. C.—W. J. Oliver & Company, of Knoxville, Tenn., has been awarded the contract for the construction of suburban lines in this vicinity by the Charlotte Rapid Transit Company. The contract embraces grading, subway bridges and track laying, and calls for the operation of the system by August 15. Storage-battery cars will be used on the line. I.

SHERMAN, TEX.—John C. Wall, mayor of Sherman, and others are promoting the construction of an interurban electric railway between this city and Paris, Tex., sixty-five miles. The route of the proposed road is via Bonham, Honery Grove and a number of smaller towns. Good progress is being made in the preliminary arrangements looking to the early construction of the line. D.

PITTSBURG, PA.—A mortgage for $700,000 given to the Guarantee Title & Trust Company of Pittsburg to cover a bond issue of a like amount by the Allegheny & Northwestern Street Railway Company has been filed. Proceeds of the bond sale will be employed in the construction of a new line twenty-one miles in length connecting with street railways at Evans City, Mars, Culmerville and Harmarville.

WAXAHACHIE, TEX.—The Commercial Club of Waxahachie has signed a contract with the Stone & Webster Engineering Corporation of Boston, Mass., for the construction of an interurban electric railway between Dallas and this city. According to the terms of the contract active work is to begin on the line within sixty days. The route from Oak Cliff, a suburb of Dallas, via Lancaster has been designated as far south as Sterett. Two surveys have been made from Sterett to Waxahachie. D.

OAXACA, MEX.—S. P. Lewison, of San Francisco, who has been investigating the situation here, with the view of constructing an extensive system of electric railway, including lines to suburban towns, is preparing to make application to the Government for a concession for the proposed enterprise. He has deferred making application on account of the unsettled political conditions, but with the assurance of peace being permanently restored he will now proceed to carry out his plans. D.

MONTGOMERY, ALA.—The work of laying the tracks of the Alabama Traction Company has been discontinued for a short period owing to some delay in securing certain franchise rights from the Board of City Commissioners. The new company has completed its tracks on Lee Street from the Union Depot to Montgomery Street, and the announcement is made by C. G. Abercrombie, president of the company, that the other construction work will be completed as early as possible. I.

INDIANAPOLIS, IND.—The total assessment of interurban companies operating in Indiana amounted to an increase of $1,190,585 over that of 1910, according to the state tax board, which has just completed its first session. In a few instances the rate per mile was slightly decreased. The total valuation of all interurban trackage, rolling stock and improvements on right of way amounted to $23,566,823, as against $22,376,238 for last year. The total value of all rolling stock operated on all roads was $1,812,806. S.

NEW IBERIA, LA.—The Southwestern Traction & Power Company of New Orleans, which is arranging to construct an interurban electric railway between New Iberia and Jeanerette, La., has been granted a twenty-five-year franchise for the use of the streets of New Iberia for its proposed railway system, and an election has been ordered for July 3 by the City Council to vote $45,000 to be raised by taxation in aid of the project. The same company has applied to the City Council of Jeanerette for a similar franchise. D.

WACO, TEX.—Authoritative announcement is made of the sale of the properties of the Citizens Street Railway Company and the Waco Gas & Electric Company to the Southern Traction Company of Dallas. Steps have been taken by the Southern Traction Company to construct an interurban electric railway between Dallas and Waco. The survey is now being made via Waxahachie and Hillsboro. The holdings of the two acquired companies in this city will be merged. The plans also involve the construction of a bridge across the Brazos River and the building of street railway lines in East Waco. D.

MACON, GA.—Plans for the construction of an interurban trolley line from Macon to Atlanta are about to be consummated. At a meeting in this city between Sir Arthur B. Elliott, of London, England, W. C. Kenyon, of Chicago, and W. Jordan Massee, president of the Central Georgia Power Company, the details of the proposed route were discussed, as well as other features in reference to the preliminary work. It is believed that the actual work will be started in the near future. The distance between Macon.

and Atlanta is more than 100 miles, and the line when completed will probably be one of the best in the country. I.

NASHVILLE, TENN.—It has been authoritatively stated that the Nashville Street Railway & Light Company will not become a part of the syndicate that is reported to have been formed for the purpose of taking over and controlling various street railway interests in the South. The merger is reported to be a gigantic concern, having a capitalization of about $60,000,000, with headquarters in New Orleans. It is stated that John J. Gannon, president of the Hibernia Bank & Trust Company, and of the D. H. Holmes Dry Goods Company, and vice-president of the New Orleans Street Railway & Light Company, will be the president of the syndicate. It is further stated that the merger will embrace street railway companies of Memphis, Little Rock, Birmingham, Chattanooga and Knoxville. While it was at first reported that the Nashville Street Railway & Light Company would become a part of this merger, it has been since learned that the local company will remain intact, owned and controlled by local capital. I.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

OVANDO, MONT.—The construction of a telephone line down the Blackfoot is projected. C.

DULUTH, MINN.—The Zenith Telephone Company is about to erect a three-story exchange building.

FRANCES, WASH.—The Willapa Harbor Telephone Company is considering the installation of an exchange. C.

CROSBY, MINN.—A franchise has been granted to the Aitkin-Deerwood Telephone Company to install a plant. C.

ABERDEEN, WASH.—The Pacific Telephone & Telegraph Company has commenced the construction of its building. C.

McMINNVILLE, ORE.—The McMinnville Mutual Telephone Association has been incorporated here with a capital stock of $1,000. A.

TACOMA, WASH.—S. A. Langwaet has applied for a fifty-year telephone and telegraph franchise covering the public highways of Pierce County. A.

HUDSON, ILL.—The Hudson Telephone Company has been incorporated with a capital of $2,000 by W. P. May, Maro B. Farwell and Floyd May.

SPRING GROVE, MINN.—The Spring Grove Telephone Company was recently incorporated with a capital of $2,500 by J. C. Gran, Ove Hoegh, C. J. Schansbger.

PIKEVILLE, KY.—The Sandy Valley Telephone Company was recently incorporated with a capital of $10,000. The incorporators are W. E. Johnson, R. M. Deskins and John W. Kerr.

NAPOLEON, O.—The Napoleon Home Telephone Company's plant, including its subsidiary plants, will be sold at receiver's sale on June 30. The plant is valued at about $38,500.

SOUTH BEND, IND.—The Central Union Telephone Company is preparing to spend $30,000 in enlarging its new exchange, opened a few months ago. About $20,000 will be used for building additional outside cable and $10,000 will be spent in enlarging the switchboard capacity of the exchange. S.

WILKESBARRE, PA.—Through a recent agreement with the Hollenbeck Telephone Company, the Bell service is extended to the country district on the east side of the Susquehanna River between Nanticoke and Berwick. This district includes Nuangola, Alberts, Dorrance, Slocum, Hobbie, Pond Hill, Wapwallopen, Pelterville and a number of other places.

EVANSVILLE, IND.—The Evansville Independent Telephone Company recently filed articles of incorporation. The capital stock is $25,000. The object of the Company is to build, equip and operate telephones and telephone exchanges in Vanderburg, Pasey, Gibson, Pike, Dubois, Perry, Spencer and Warrick counties, Indiana. The incorporators are E. B. Olsage, E. Y. Lockyear, H. T. Cooper, M. H. Gatsch and Paul J. Fischer. S.

FINDLAY, O.—Farmers in this vicinity are busily engaged with a plan to form a new telephone company, erecting independent lines connecting about forty towns. The action comes in retaliation because the Ada Telephone Company, upon which they formerly relied for service, recently raised the rates from $1 to $1.25 per month. The organization has already been effected, with Christian Hilty as president, J. W. Shilling, vice-president, Shell Deith, secretary, and Noah O. Blossom, treasurer. H.

BIRMINGHAM, ALA.—W. T. Gentry, of Atlanta, president of the Southern Bell Telephone Company, has appeared before the Board of City Commissioners of the city with a view of increasing rates on all telephone lines except those used by residences. If the total increase which the Telephone Company proposes is consummated, it will represent an additional sum of about $60,000 annually to the company in Birmingham. The increase will mean an additional dollar a month on special business lines, duplex lines, limited-message lines and duplex residence lines. In asking for the increase, Mr. Gentry informed the Commission that no changes had been made in the charges for twelve years, and declared that the company had been at such an enormous expense that there was no profit. I.

ELECTRICAL SECURITIES.

There has, owing to the Standard Oil decision, been a general increase in trade and the outlook is in every way good. In spite of the recent holiday there was a substantial increase in transactions in securities.

The Chicago Stock Exchange announces the listing of $9,600,000 additional Commonwealth Edison first fives of 1943, making total listed to date $26,000,000.

The Chicago Railway's passenger earnings for May amounted to $1,427,624, or eleven per cent increase.

The gross earnings of the Massachusetts Electric Companies increased $86,500 during May, which is equal to a fifteen-per-cent increase in business over May, 1910.

Holders of the ten-year debenture five per cent bonds of the General Electric Company are now at liberty to exchange them for stock at par. The outstanding debentures amount to $12,875,000, and it is expected that the entire issue will be turned in for stock, which is paying eight per cent annually. The present outstanding stock is $65,179,600, which will be increased to $78,054,600 if all the bonds are converted.

Net profits of National Carbon for the first quarter of its current fiscal year were about thirty-three per cent less than for the same period a year ago. At the same time gross sales were nearly ten per cent larger. The shrinkage of slightly over $100,000 in net during this period is not wholly accounted for, however, by a reduction in prices or higher operating costs. In part it represents expenditures incurred in connection with the building of a new $400,000 plant at Niagara Falls which is to be used to make carbon electrodes and which will be finished in all probability and in operation this fall.

President Budd, of the Metropolitan Elevated, Chicago, says the remainder of the year should show an increase in earnings because traffic is improving as compared with the early months, while the strikes of last fall caused heavy loss. Mr. Budd expects this year's earnings will nearly equal those of last year. South Side Elevated traffic the past few weeks has averaged more than a year ago. Northwestern Elevated monthly reports—the only ones issued—have shown a gain of less than one per cent this year. The Oak Park Elevated never publishes any kind of a statement, but its business as usual is supposed to represent a deficit. Chicago Railways and City Railway earnings since the beginning of their fiscal year February 1, have gained in the aggregate about ten per cent.

DIVIDENDS.

Butte Electric Light & Power Company, quarterly common dividend of one and three-quarters per cent payable July 1.

Chicago Telephone Company, quarterly dividend of two per cent, payable June 30.

Massachusetts Electric Company; regular semiannual dividend of $2 on the preferred stock, payable July 1 to stock of record June 5.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.	June 5.	May 29.
Allis-Chalmers common	9¼	8¼
Allis-Chalmers preferred	32	30¼
Amalgamated Copper	67	67
American Tel. & Cable	80½	81
American Tel. & Tel.	149⅝	148⅝
Brooklyn Rapid Transit	80¾	79¾
General Electric	163½	164¼
Interborough-Metropolitan common	19	18½
Interborough-Metropolitan preferred	52⅛	52
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common.	89½	89½
Mackay Companies (Postal Telegraph and Cables) preferred	75¼	75
Manhattan Elevated	137	136
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	50⅜	50½
U. S. Steel common	78⅛	77
U. S. Steel preferred	119	119
Western Union	81½	82¼
Westinghouse common	75	77¼
Westinghouse preferred	113	117

*Last price quoted.

BOSTON.	June 5.	May 29.
American Tel. & Tel.	149¾	148¾
Edison Elec. Illuminating	286	287
General Electric (ex-dividend)	164	164
Massachusetts Electric common	23¾	26¾
Massachusetts Electric preferred	92½	89½
New England Telephone	146½	146
Western Tel. & Tel. common	19½	19
Western Tel. & Tel. preferred	94	94

PHILADELPHIA.	June 5.	May 29.
American Railways	44	43¾
Electric Company of America	12	12
Electric Storage Battery common	54½	53
Electric Storage Battery preferred	54½	53
Philadelphia Electric	16½	16⅜
Philadelphia Rapid Transit	18	17
Philadelphia Traction	82½	83
Union Traction	46	47

CHICAGO.	June 5.	May 29.
Chicago Railways, Series 1	80	75
Chicago Railways, Series 2	21½	22½
Chicago Subway	4	4
Chicago Telephone	123	121
Commonwealth Edison	128½	129
Metropolitan Elevated common	27	25½
Metropolitan Elevated preferred	72¼	72

PERSONAL MENTION.

EDGAR S. HURLEY, formerly in the San Francisco Department of Electricity, has been appointed chief electrician for the Geary Street Municipal Railroad.

GEORGE M. COX has been appointed acting general manager of the Middlesex & Boston Street Railway Company to succeed Carl A. Sylvester. Mr. Cox will assume his new duties on June 20.

L. E. SPERRY, formerly manager of the California Electrical Works, has established offices and warehouse for the New York Insulated Wire Company at 629 Howard Street, San Francisco, Cal.

WILLIAM UNDERWOOD, a graduate of the forestry school, University of Minnesota and an expert in wood preservation, has been secured by Page & Hill Company to take charge of their pole-preserving plant at Minnesota Transfer.

L. D. GIBBS, of the Edison Electric Illuminating Company, of Boston, delivered an address May 26 before the New England Section of the Electric Vehicle Association of America at its meeting in Boston. The subject of Mr. Gibbs' address was "Advertising."

A. E. KENNELLY of Harvard University will deliver a course of lectures at the University of London, on the properties of the hyperbola in relation to the solution of electrical engineering problems. The lectures will be delivered in the hall of the Institution of Electrical Engineers.

FRANK I. HARDY has resigned as superintendent of transportation of the Ft. Wayne & Northern Indiana Traction Company. Mr. Hardy has held the position for five years, having previously served the Indiana Union Traction Company in like position. Mr. Hardy retires to enter business in Huntington.

EUGENE EICHEL, editor of the German electrical journal, *Electriche Kraftbetriebe Bahnen*, and consulting engineer of Berlin, Germany, has founded with G. S. Ackley, a German company for the manufacture of Ackley brakes in Germany, Austria-Hungary and Russia. The new firm is to be known as the Deutsche Ackley Bremsen Company.

JAMES ENGLISH, president of the United Illuminating Company, of New Haven, Conn., married Miss Leila Elisabeth Earle of that city on Thursday, June 1. Mr. English recently took a beautiful home in the Elm City, which he will occupy after a honeymoon trip. He is one of the best known men in the electric-lighting industry of New England, and a leading resident of the State of Connecticut.

ALTEN S. MILLER recently tendered his resignation, to take effect July 1, as president and general manager of the Union Electric Light & Power Company, of St. Louis, Mo. He will again become connected with Dr. Alex C. Humphreys of Hoboken, N. J., with whom he was associated formerly. Mr. Miller will be given a farewell banquet June 27 by the St. Louis League of Electrical Interests and the St. Louis branch of the National Electric Light Association.

G. H. STICKNEY has been appointed assistant to the manager of incandescent-lamp sales of the General Electric Company at Harrison, N. J., and will take charge of the illuminating engineering work there. He will work toward bringing about more intimate relation between illuminating engineering and the incandescent-lamp sales, and will carry on a campaign of instruction with the incandescent lamp sales force. Mr. Stickney graduated from Cornell in 1896, immediately entering the students' course at Schenectady. In February, 1898, he was transferred to Lynn, Mass., but spent the first few months with the Volunteer Engineer Corps in Boston Harbor. In July of that year as a result of some suggestions, which simplified and improved the photometric work he was put in charge of the photometric test under W. D. A. Ryan. Since then he has acted as Mr. Ryan's first assistant, taking up various problems, first in arc lighting, and later, especially since the development of tungsten filament lamps, in incandescent lighting also.

OBITUARY.

HARMON M. SAGE, general superintendent of the Western Electric Company, died May 31 at his residence in Evanston, Ill., after a long illness. He is survived by a widow and daughter. Mr. Sage was a member of the Union League and Evanston Clubs.

THADDEUS M. SCHNELL, a member of the First United States Military Telegraph Corps, formed by Andrew Carnegie at the outset of the civil war, died recently at his home in Des Moines, Iowa, as the result of an operation. He was seventy-seven years old. He was a collaborator with Thomas A. Edison in an improvement of telegraphy.

PROPOSALS.

LIGHTING SYSTEM.—Capt. E. C. Long, constructing quartermaster, Seattle, Wash., will receive bids in triplicate until June 15 for the construction of an electric lighting system at the fort. C.

POST OFFICE, WASHINGTON, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until July 5, for the construction including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures of the United States post office and court house at Washington, N. C., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Washington, N. C., or at the Supervising Architect's office.

LEGAL NOTES.

MAY ISSUE BONDS FOR LIGHT PLANT.—The Supreme Court of California has handed down a decision which permits the City of Los Angeles to issue $3,500,000 worth of bonds for the purpose of building and maintaining its own light and power plant as authorized by a vote of the Los Angeles electors in April, 1910. The decision was on the injunction proceedings begun by Percy H. Clark to prevent the sale of the bonds. The city won in the lower court, and the case was appealed. The decision of the Supreme Court upholds that of the lower court.

AUTHORITY OF MUNICIPALITY TO FURNISH LIGHTS.—A municipality cannot furnish lights for private use unless specially authorized. But a provision may be sufficiently explicit without containing words of direct authorization. For example, a sale of lights of users others than the village is necessarily implied by a village charter which premises that the charges for electric lighting are to provide an income for paying interest on and ultimately extinguishing the debt incurred in providing an electric plant.—Supreme Court of Vermont in Rand vs. Marshall, 78 Atl., 790.

INDIANA TRACK ELEVATION DECISION.—The Indiana Supreme Court has decided that the Indianapolis Light & Power Company is not entitled to damages from the city on account of having ordered railway tracks elevated, thereby damaging the plant, its conduits and wires. The Court held that the company accepted its franchise subject to all changes that may be made in the streets calculated to benefit the people and no damages can be collected from the city. The Board of Public Works had allowed the Light & Power Company $25,000 and now the Supreme Court says that amount must be returned to the city. S.

HOURS FOR TELEPHONE EXCHANGES.—The Supreme Court of Oklahoma holds that a telephone company is required to operate its exchange during reasonable hours of every day in the week, including Sunday, in order to comply with its charter and franchise obligations. As to what are reasonable hours depends upon the size of the town or village, the number of patrons, and the amount of income and expense, and the demand for service. What may be reasonable hours on a week day may be unreasonable hours on a Sunday. Evidence is also admissable to show the reasonable demand for service during the night time of every day in the week, and also during the daytime on Sundays. When it is sought, by the constitutional provision, that the corporation commission shall have the power and be charged with the duty of regulating all transmission companies doing business in the state, to require a telephone exchange to be kept open and operated during the night time at a pecuniary loss when the patronage of the company will not reasonably support the operation of said exchange during such night time, such order is unreasonable and unjust.—Twin Valley Telephone Company vs. Mitchell, 113 Pac., 914.

NEW INCORPORATIONS.

ATHENS, TEX.—The Athens Telephone Company has been incorporated with a capital of $25,000 by J. A. Jones, J. W. Murchison and E. A. Carroll.

FAIRMONT, W. VA.—The East Side Telephone Company was incorporated with a capital of $10,000. The incorporators are A. A. Hamilton, D. S. Huffman, G. M. Nuzum and Paul Hamilton.

NEW YORK, N. Y.—The Franco-American Electric Novelty Company has been incorporated by John Smith, Samuel Posen and Morduch L. Kaplan to manufacture electric supplies, etc. The capital is $40,000.

LAFAYETTE, IND.—The Lafayette Electric & Manufacturing Company has purchased the property and equipment of the Sterling Electric Works and will manufacture telephones and other electric supplies on an extensive scale. S.

MANHATTAN, N. Y.—The Engler Corporation has been incorporated with a capital stock of $10,000 to manufacture electrical and scentific instruments. The incorporators are Lewis H. Saper, Hans R. Freund, Leonhart H. Freund, and Max Engler.

PORTLAND, TEX.—The Portland Development Company has been formed here with a capital stock of $60,000 for the purpose of installing public-utilities plants and making other improvements to the town. The incorporators are John G. Willacy, J. M. Eskridge and E. C. Wessendorff. D.

INDUSTRIAL ITEMS.

THE EASTERN ELECTRIC LAMP COMPANY, Boston, Mass., has mailed colored advertising cards mentioning the Eastern Mazda lamp.

MATHIAS KLEIN & SONS, Chicago, are now distributors for the Standard expansion bolt. This bolt, it is claimed, stands all strain, and prevents slipping, loosening or pulling out.

LAMONT, CORLISS & COMPANY, 131 Hudson Street, New York, N. Y., have issued a folder advertising the Laco lamp. This is an imported tungsten lamp made in the American standard shapes to fit standard sockets.

THE GENERAL VEHICLE COMPANY, Long Island City, N. Y., includes in the May number of *Elec-Tricks* a description of the equipment of G. V. electrics which the Hartford Electric Light Com-

pany employs. Another short article deals with the electric versus the horse for brewery deliveries.

ALLIS-CHALMERS COMPANY, Milwaukee, Wis., lists in Bulletin No. 1524 a line of repair parts for auxiliary air-brake apparatus. Bulletin No. 1210, mailed at the same time, describes the universal bolter with vibromotor drive.

THE MORRIS IRON COMPANY, Frederick, Md., describes and illustrates a varied line of street lighting posts and poles in Catalog No. 20, which has just been distributed. Each of the styles is illustrated and prices are given throughout.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., recently distributed Bulletin No. 9, on Benjamin street lighting fixtures. Two-way parabolites, flat-cone reflector fixtures and radial-wave reflector fixtures are among those illustrated.

PETTINGELL-ANDREWS COMPANY, Boston, Mass., has distributed the May number of its monthly publication, *Juice*. The leading article in this issue describes the lighting of the new John Hay Library Building of Brown University, Providence, R. I.

THE HUGHES ELECTRIC HEATING COMPANY, Chicago, Ill., is mailing a catalog describing the 1911 models of the Hughes electric stoves, ranges and hot plates. Especial attention is directed to the pages of the catalog containing letters of recommendation from the company's customers.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has distributed a pamphlet on its drum-type crane controllers. The principal features are each described briefly and illustrations and diagrams are made use of. Especial attention is given to the dynamic-brake controller which is described at considerable length.

THE PAGE & HILL COMPANY, Minneapolis, Minn., has just installed at its Minnesota transfer yard a plant for giving cedar poles a preservative treatment. Its engineers realize that wood preserving has gone beyond the experimental stage and that it has been demonstrated beyond a doubt, that a proper and thorough preservative treatment will double or triple the life of a pole, thereby effecting a very substantial saving in the per-annum cost of pole-line maintenance.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., has issued bulletins on its direct and alternating-current motors and on induction meters. Bulletin No. 1127 describes direct-current grinders and buffers showing a number of illustrations of individual machines, as well as those assembled in the shop for operation. Bulletin No. 1128 deals with multiphase induction motors. In Bulletin No. 1129 descriptive matter is given on the multiphase induction watt-hour meter, type K, and a number of wiring diagrams are also included. An instruction book, No. 3048, on type A, form A, oil transformers has also been distributed.

THE PULSOMETER STEAM PUMP COMPANY, New York, N. Y., has issued a hand-book fully illustrated with numerous recent photographs showing the Pulsometer employed for different kinds of work. It explains fully the operation and construction of the Pulsometer and the chapter on steam economy shows that inasmuch as the Pulsometer is really a condensing engine, it uses less steam per gallon of water lifted than the ordinary reciprocating pump. Different paragraphs are given explaining the special adaptability of the Pulsometer for a variety of uses and the tables on pipe sizes, loss of head due to friction in pipes and other data on the flow and pumping of water should interest all engineers.

THE WESTERN ELECTRIC COMPANY has issued Bulletin No. 1080 on the subject, "Railroad Telephone and Selective Apparatus." A four-page insert is devoted to the Western Electric selector, with photographs of the installations of this apparatus on three of the large trunk railroads. The selector and selector sets for local and common-battery signaling are described in detail, and the advantages of the standard Western Electric telephone and selective equipment are clearly stated. The bulletin itself contains fifty-six pages. It lists, together with full information as to types and prices, a great variety of apparatus, including batteries and battery boxes, bells, and telephone sets of all descriptions.

THE FLOUR CITY ORNAMENTAL IRON WORKS, Minneapolis, Minn., has issued a new and attractive catalog of the latest types of ornamental lamp standards. Although there has been an enormous demand for this company's lamp standards, this is the first real catalog that has been issued by the lamp standard department, and it contains several noteworthy points. A number of full-page illustrations are used in the brochure and one interesting feature is that in each engraving the design is represented on a scale of one-half inch to a foot. The posts and standards of this company are not only used in all the large cities of the United States, but are also supplied in large quantities to the Government.

THE BADT-WESTBURG ELECTRIC COMPANY, Chicago, Ill., has been incorporated to succeed F. B. Badt & Company, which at the request of the stockholders has been legally dissolved. The new company will assume all assets and liabilities of the former corporation. Paul A. Westburg, who is a new member of the firm, had been connected with the old company for about eleven years, but severed his connection to go into another line of business. He has now returned to his former associates as an active member of the new company. The main business of the company will be, as heretofore, the selling of the products of the Weston Electrical Instrument Company and the Ward Leonard Electric Company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., reports that recent business in street-railway motors includes orders from the Hummelstown & Campbellstown Street Railway, Hershey, Pa.; the Nashville Railway & Light Company,of Nashville,Tenn.; the Cumberland Electric Railway Company, Cumberland, Md.; the Frederick Railroad Company, Frederick, Md., and the Connecticut Company, of New Haven, Conn. Among the foreign business lately secured by the same company is an order from the Takaski Water-Power Electric Company, of Japan, for two double equipments of No. 12A street-railway motors with type 210D controllers. The order was placed through Takata & Company, the Westinghouse Company's representatives in Japan.

PEERLESS V-BELT COMPANY, maker of noiseless high-speed chains for power transmission, will move this month to its new factory in Cedar Rapids, Iowa. The Peerless V-Belt Company was incorprated under the state laws of Illinois with a capital stock of $100,000, which is now increased to $300,000. The new factory will have a capacity of four times that of the present one, which will enable the company to take care of its constantly increasing business. It is the intention of the company to start branch offices in a number of the larger cities. There are at present offices in St. Louis and Chicago. Each of the branch offices will carry a stock for immediate shipment. Wheels used in connection with the drive may be made by parties ordering belts, or can be furnished from any of the branch offices.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has just issued bulletin No. 4819, which is devoted to the subject of alternating-current switchboard panels. The panels described are equipped with oil switches, and are suitable for general use in the central stations and isolated plants. They are designed for use with one set of busbars, to which all generators and feeders are connected by means of single-throw oil switches and suitable provision is made for the parallel operation of generator. These panels are for use on three-phase, three-wire circuits of 480 and 600 volts and twenty-five to sixty cycles. The bulletin contains information including dimension and connection diagrams regarding three-phase generator panels, single-circuit and double-circuit three-phase feeder panels, generator voltage-regulator panels and combination regulator and exciter panels and the three-phase induction-motor panels. Bulletin No. 4825, issued at the same time, illustrates and describes a line of compact, accurate and moderate priced instruments for use on alternating and direct-current switchboards. The bulletin contains dimension diagrams and also illustrations showing the actual size of the meter scales. These illustrations will enable a prospective customer to see at a glance the ease with which readings may be made. Bulletin No. 4831 describes briefly a type of oil-switch suitable for installation in manholes. These switches are made single, double or triple-pole, single-throw, and are for use on circuits on voltages up to 7,500. The normal current rating is 200 amperes. Pamphlets have also been distributed describing the radiant toaster and electric flatiron.

DATES AHEAD.

Canadian National Electrical Credit Association. Toronto, Ont., June 13-16.

American Society of Civil Engineers. Annual convention, Chattanooga, Tenn., June 13-16.

Association of Railway Electrical Engineers. Semi-annual convention, Washington Terminal Station, Washington, D. C., June 16 and 17.

National Gas and Gasoline Engine Trades Association. Convention, Detroit, Mich., June 19-23.

Association of Railway Telegraph Superintendents. Annual meeting, Boston, Mass., June 26-30.

Michigan Electric Association. Annual convention, on board steamer *Minnesota*, leaving Grand Haven, Mich., June 19, returning to St. Joseph, Mich., June 22.

Mississippi Electric Association. Annual convention, Gulfport, Miss., June 20-21.

Canadian Electrical Association. Annual convention. Niagara Falls, Ont., June 21-23.

American Institute of Chemical Engineers. Semi-annual meeting, Chicago, Ill., June 21 to 24.

Society for the Promotion of Engineering Education. Annual meeting, Pittsburg, Pa., June 26, 27 and 28.

American Institute of Electrical Engineers. Annual convention, Chicago, Ill., June 26-30.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 27 to July 1.

American Chemical Society. Annual meeting, Indianapolis, Ind., June 28-30.

National Electrical Contractors' Association. Niagara Falls, N. Y., July 19.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 25-28.

International Association of Municipal Electricians. Annual convention, St. Paul, Minn., September 12-15.

American Electric Railway Association. Annual convention, Atlantic City, N. J., October 9 to 13.

Association of Railway Electrical Engineers. Annual convention, LaSalle Hotel, Chicago, November 6-10.

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(Published in the second issue of each month.)

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) May 30, 1911.

993,340. MECHANICAL MOVEMENT. Tonjes August Carl Both, New York, N. Y., assignor to Ida S. Rosenheim, New York, N. Y. Filed July 2, 1910. A keyed electric lamp socket has a mettallic driving member and an insulating driven member spliced to a metallic key.

993,346. ADVERTISING DEVICE. John Buckley, Boston, Mass.,

assignor to Adolph Sommer, trading as Viscol Co., East Cambridge, Mass. Filed March 1, 1911. An electric motor is arranged to rock a frame carrying a waterproof shoe into and out of a tank of water.

993,352. ELECTRIC DRILL. William O. Duntley, Chicago, Ill., assignor to Chicago Pneumatic Tool Co., Chicago, Ill. Filed Jan. 20, 1905. A central tool-holding spindle for a portable drill is driven through spur gears by several motors arranged annularly around it with the armatures and fields alternating in the circular casing.

993,359. ALTERNATE-CURRENT MOTOR. Valère Alfred Flynn, Blackheath, England. Filed March 2, 1908. A single-phase motor has a field winding, an auxiliary winding and a neutralizing winding on the stator. The rotor carries a commutator winding in series with the neutralizing winding, and an existing winding in series with the field winding.

993,362. APPARATUS FOR IGNITING MINERS' SAFETY-LAMPS. Ernest Arthur Hallwood, Morley, near Leeds, England. Filed Dec. 8, 1908. Has two chambers into the inner of which the lamp is placed. Just as the inner chamber is closed an electric contact is exposed and the ignition circuit energized.

993,375. SHORT-CIRCUITING DEVICE FOR MAGNETO-ELECTRIC IGNITING APPARATUS FOR EXPLOSION-MOTORS. Gottlob Honold, Stuttgart, Germany. Filed August 7, 1906. Includes a ring with alternate contact and insulating segments, the former alternately connected to each igniter and the intermediate ones connected to the generator. A rotating brush connects the adjoining contact segments.

993,378. SWITCH. John W. Jepson, Depew, and William F. Bouché, Buffalo, N. Y., assignors to Gould Coupler Co. Filed June 10, 1910. A wheel carries a switch-throwing attachment eccentrically pivoted so as to throw a knife switch alternately to opposite contacts regardless of the direction of rotation of the wheel.

993,414. ELECTRIC FURNACE. Francesco Sartori, Monteponi, Italy, assignor to Societa di Monteponi, Turin, Italy. Filed August 19, 1910. A resistance furnace for distillation of zinc has a muffle into the mouth of which a zinc condenser can be connected.

993,417. ELECTRICAL CONTROL APPARATUS. William M. Scott, Philadelphia, Pa., assignor to Cutter Electrical & Manufacturing Co. Filed Jan. 6, 1910. A motor is provided for operating any one or a number of circuit-breakers, but not all at once. Electro-mechanical clutches connect the motor to the circuit-breakers.

993,419. SHADE-HOLDER FOR ELECTRIC FIXTURES AND THE LIKE. Wickham B. Spear, Los Angeles, Cal. Filed Jan. 16, 1911. Consists of two semi-annular clamping members, one of which is resilient.

993,434. MULTIPLE-SWITCH STARTER. Frank R. Bacon, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Filed August 2, 1909. Includes a number of manually operated switches mechanically interlocked to close in a definite sequence, and automatic means for checking the progressive operation of the switches.

993,437. RECORDING DEVICE. Edward S. Cole, New York, N. Y. Filed May 8, 1909. Comprises a U-tube, a pair of floats, one in each side of the tube, contacts with circuit connections adapted to be closed by the floats, and a series of electro-magnetically operated recording devices actuated by the circuit connections.

993,442. TELEGRAPHY. John A. Esslinger, Washington, D. C. Filed May 23, 1910. Combined with an inductive reciprocating sounder is an interacting shunt relay and a diaphragm receiver.

993,447. OSTEOPATH'S ELECTRIC OPERATING-TABLE. Charles W. Hotchkiss, Sandwich, Ill. Filed Dec. 3, 1909. The table contains a battery and induction coil. One side of the secondary of the latter is connected to a conductive covering on the table, the other side to a mat on the floor, the circuit being closed through the bodies of the patient and operator.

993,459. ELECTRIC MOTOR. Harry A. Rhodes, Denver, Colo., assigner to Universal Motor Co., Denver, Colo. Filed July 20, 1909. A motor whose field and armature are mounted to rotate in opposite directions, has extensions at one end of the motor, including circular bearing parts, a speed-regulating device adapted to engage them and means arranged coaxially with the motor for adjusting the speed-regulating device to produce any desired differential speed in favor of either motor member.

993,460. ELECTRICAL ALARM DEVICE. Alvey J. Rice, Lawrenceburg, Ky., assignor of one-half to Thomas B. McGurk, McBrayer, Ky. Filed April 27, 1910. On an insulating base are two binding posts of an alarm circuit adapted to be connected by a contact rod.

993,475. ELECTRIC-CURRENT CONTROLLER. George G. Thompson, Muskegon, Mich., assignor to American Electric Fuse Co., Muskegon, Mich. Filed Jan. 5, 1911. A motor-starting rheostat has starting and running fuses. When the contact arm reaches running position, the starting fuse is cut out and the running fuse cut in.

993,525. LAMP-HANGER. Lloyd B. Hornbeck, Minneapolis, Minn. Filed April 22, 1909. Inside the casing is a yieldingly suspended block acting as a shock absorber for the lamp.

993,526. ELECTRIC SWITCH. Albert J. Horton, White Plains, N. Y., assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Filed Sept. 14, 1908. A motor starter has a movable contact adapted to be magnetically held in engagement with the switch when the same is moved in one direction, and means for causing the contact to break engagement with the switch upon reaching a certain position, a blow-out coil preventing arcing.

993,528. IGNITER MECHANISM FOR EXPLOSIVE ENGINES. Edward A. Johnston, Chicago, Ill., assignor to International Harvester Co. Filed Jan. 12, 1911. Includes a plug carrying a fixed and a rocking electrode.

993,542. SOUND-RECORDING APPARATUS. John Noll, Brooklyn, N. Y., assignor of one-half to Eugene Del Mar, New York, N. Y. Filed Jan. 31, 1910. An electrically-driven phonograph is connected with a transmitter, an electric lamp being lighted when the connection is an operative one.

993,559. ELECTRICALLY-PROPELLED VEHICLE. Robert Siegfried, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa. Filed April 10, 1908. Renewed March 20, 1911. The drive wheels are connected by a rigid axle around which is a flexible quill, at each end of this being a gear meshing with a pinion on each end of the motor ramature shaft.

993,561. APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY INTO MECHANICAL ENERGY. Harold B. Smith, Worcester, Mass., assignor to Westinghouse Electric & Manufacturing Co. Filed May 14, 1908. An electrostatic motor has a stator connected to a polyphase source, so as to produce a revolving electrostatic field, and a rotor made of isolated electrical parts mounted so as to be drawn around by the revolving field.

993,568. ELECTRIC-MOTOR DRIVE FOR LOCOMOTIVES AND OTHER RAILWAY-VEHICLES. Norman W. Storer, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed October 7, 1908. Embodies an idea similar to No. 993,559, but the driven gears have a flexible connection between the rim and hub and are mounted on a rigid quill.

993,570. RESILIENT DRIVING CONNECTION. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed July 6, 1908. The rotor of the motor has a hollow shaft in which is a rod connected to the rotor at one end and to a gear at the other end.

993,589. ELECTRIC-RAILWAY VEHICLE. George M. Eaton, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manucacturing Co. Filed Sept. 8, 1908. Combined with two pairs of driving wheels and quills surrounding their axles is a motor located between the axles and having bearings upon the quills, intermeshing gear wheels connected respectively to the motor and to the quills, and means operatively and resiliently connecting the quills to the driving wheels.

993,610. SYNCHRONIZING DEVICE. Fernand Emile Auguste Mathelot and Henri Georges Gentilhomme, Paris, France. Filed April 23, 1908. Includes a pair of wheels operated step-by-step by means of a pair of electromagnets, one of the wheels carrying two insulated sectors, also two motors, a series of relays and an electric brake mounted on one of the motor shafts.

993,611. ELECTROMAGNETIC POWER-VELOCITY-RATIO DEVICE, PARTICULARLY APPLICABLE FOR DRIVING AUTOMOBILES. Albert Henry Midgley, Forest Gate, and Charles Anthony Vandervell, Acton Vale, England. Filed May 7, 1909. Comprises a combined motor and dynamo with a common field. The dynamo armature is mounted on the shaft; about this is a rotatable field and on the outside is the stationary motor armature.

993,619. VEHICLE-MOTOR. Charles A. Psilander, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Dec. 2, 1909. Relates to the mounting and protection of the gears connecting the motor armature and the driving axles.

993,637. CIRCUIT-BREAKER. Charles C. Badeau, Bethlehem, Pa., assignor to Roller-Smith Co., New York, N. Y. Filed Feb. 19, 1908. One of the contacts is a carbon cylinder and other is a cast-iron block with a notch fitting the curve of the cylinder.

993,638. PROPULSION OF VESSELS IN WATER. James Nicolson Bailey, Stretford, England, assignor to Westinghouse Machine Co. Filed May 17, 1909. Includes a steam turbine driving a polyphase generator, a reversible motor supplied thereby through a controller and fluid-pressure brake on the turbine.

993,669. POWER TRANSMISSION FROM A CAR-AXLE FOR GENERATING ELECTRIC CURRENT. Joseph Augustine Faguy, Montreal, Quebec, Canada. Filed March 7, 1910. A generator is mounted on the lower edge of the car and driven by a flexible shaft joining the axle and a bevel-gear set.

993,688. BURGLAR AND FIRE ALARM SYSTEM. John M. Johnson, Belleville, Kans. Filed Oct. 12, 1909. A spring actuated contact-closing wheel is restrained from turning by two strands, one of which is separable by heat.

993,727. ELECTRIC TOY. Ekko Sollmann, Hoboken, N. J., assignor to Geo. Borgefeldt & Co., New York, N. Y. Filed March 4,

1910. A toy third-rail track is provided with a switch so that the electrical connection may easily be reversed.

993,756. SWITCH. Frank C. Chlan, Baltimore, Md., assignor of one-half to Charles L. Stockhausen, Baltimore, Md. Filed August 6, 1910. Has a head provided with an engaging face pivotally connected with the supporting structure, a lever connected with and adapted to be moved by the head, and a push-rod disposed near the head to effect a movement of the same when moved toward the head.

993,762. CLUSTER-SOCKET. John H. Dale, New York, N. Y. Filed May 11, 1910. A cluster of incandescent lamp sockets mounted on an insulating base is arranged to attach to a live socket. Contact between sockets is made by a strip, one terminal of each socket being in electrical connection with the exposed end of one strip, while its other terminal is in electrical connection with the opposite end of the next adjacent strip.

993,792. TROLLEY-HARP. John Lewis Perkins and Clesson W. Putnam, Holyoke, Mass., assignors to D. F. Perkins & Son, Holyoke, Mass. Filed Jan. 28, 1910. The trolley harp has a recess in its base at right angles to the axes of the pole and wheel. The lower parts of a pair of contact springs fit tight against the walls of the recess.

993,804. AUTOMATIC SWITCH. Albert B. Strohm, Columbus, O. Filed Dec. 15, 1910. A fluid-controlled diaphragm moves a lever arm which throws an electric switch into and out of contact.

993,814. MOTIVE-POWER-CONTROLLING DEVICE. Thomas E. Barnum, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Co. Filed July 1, 1907. Comprises a pair of movable members having directly engaging contacts, one of the members being movable at will, and electromagnetic means for moving the other member in synchronism with the motor in a step-by-step manner, the first-mentioned member being movable in opposite directions to control the direction of operation of the motor and the range of operation of the device.

993,832. EMERGENCY GOVERNING MECHANISM FOR TURBINES. Oscar Junggren, Schenectady, N. Y., assignor to General Electric Co. Filed Nov. 4, 1909. A turbine governor is provided with an auxiliary electro-magnet which can actuate the trigger operating the governor.

993,843. HIGH-VOLTAGE MERCURY-ARC RECTIFIER. Osias O. Kruh, Schenectady, N. Y., assignor to General Electric Co. Filed Sept. 20, 1907. Combines a cathode, a plurality of anodes, and means within the apparatus for preventing abnormal lag of the starting of the arcs from the respective anodes to the cathode with respect to the phase of the impressed electromotive forces.

993,872. MERCURY-METER. William H. Pratt, Lynn, Mass., assignor to General Electric Co. Filed April 9, 1908. Has a cup-shaped armature revoluble in mercury between the poles of the magnet, a magnetic member substantially filling the interior of the armature, conductors leading current to diametrically opposite edges of the armature, and a retaining member rigidly attached to the magnetic member and the conductors and revolubly adjustable about the armature axis.

993,877. LAMP-SHADE. Johann Jakob Ritter, Basel, Switzerland. Filed March 1, 1911. A lamp shade has an upper reflector and a lower glass distributor provided with concentric corrugations.

993,878. COIN-TESTING DEVICE FOR VENDING-MACHINES. Peter A. Robichon, New York, N. Y. Original application filed April 27, 1906. Divided and this application filed May 21, 1907. The coin passes before the poles of a permanent magnet.

993,899. VAPOR RECTIFIER SYSTEM. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Co. Filed June 21, 1907. Has a plurality of anodes and reactive means between the current source and the anodes and reactive means in the same direction for current to either anode.

993,910. SPEED-INDICATOR. Elihu Thomson, Swampscott, Mass., assignor to General Electric Co. Filed June 29, 1908. Has means for producing a magnetic field, and a rotatable armature having a plurality of conductors of low-resistance metal mounted side by side in inductive relation to the field and connected outside of the field through metal having a low temperature coefficient to form a plurality of closed circuits side by side on the armature.

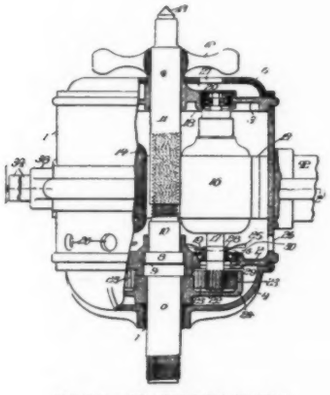
993,944. ELECTRIC-MOTOR ATTACHMENT FOR SEWING-MACHINES. Henry S. Baldwin, Lynn, Mass., assignor to General Electric Co. Filed Oct. 14, 1909. The sewing machine is driven through a countershaft operated by the motor.

993,946. CUT-OUT FOR ELECTRICAL CIRCUITS. John T. Beechlyn, Lynn, Mass., assignor to General Electric Co. Filed Aug. 17, 1908. Comprises a dash-pot, a magnetic plunger therein provided with a check-valve to retard upward movement, an electromagnet coil concentric with the upper portion of the dash-pot, movable magnetic jaws adapted to close upon the upper end of the dash-pot and switch tripping mechanism actuated by the jaws.

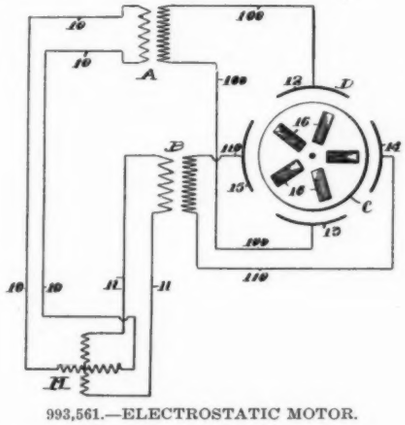
993,961. ELECTROLYTIC LIGHTNING-ARRESTER. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Co. Filed Oct. 11, 1907. Renewed Oct. 5, 1910. Has a series spark gap and means for closing the gap responsive only to a continuous discharge of current.

993,965. EGG-TESTER. Isaac Davis, Las Vegas, N. Mex. Filed Feb. 9, 1911. Illumination is supplied by an electric lamp, which is contained in a small box.

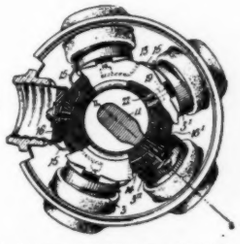
993,968. SNAP-SWITCH WITH INCLOSED FUSE. Frank C. De Reamer, Schenectady, N. Y., assignor to General Electric Co. Filed April 22, 1905. The fuse is removably attached to the switch blade.



993,352.—ELECTRIC DRILL.



993,561.—ELECTROSTATIC MOTOR.



993,762.—CLUSTER SOCKET.

993,973. THREE-WIRE GENERATOR. Hermann F. T. Erben and Joseph L. Burnham, Schenectady, N. Y., assignors to General Electric Co. Filed June 21, 1907. The combination with three leads of a main armature winding for supplying two of the leads, a continuous auxiliary winding closed upon itself and generating a different electromotive force than the main winding and having different points connected to the main winding and to the third lead to maintain a constant difference of potential between the third lead and the other two.

993,975. TELEPHONE-SUPPORT. Charles E. Flynn, Vale, Ore. Filed Feb. 25, 1911. An attachment permanently holds the receiver of a desk telephone in such a position as to be at the ear of the person talking. The receiver hook is raised and lowered by a grip which is fixed to the handle of the telephone.

993,977. PRESSURE-OPERATED CIRCUIT-CONTROLLER. Fred J. Frasier, Minneapolis, Minn. Filed April 19, 1910. The circuit is opened and closed by means of variations of pressure upon a diaphragm.

994,010. METHOD OF AND APPARATUS FOR PRODUCING EXHAUSTED VESSELS. Irving Langmuir, Schenectady, N. Y., assignor to General Electric Co. Filed Oct. 22, 1910. The object from which air is to be exhausted is placed in a heated vessel from which air is exhausted. Although the object may be heated to the point of softening, there is substantially no difference between the inside and outside and hence can be no distortion.

994,011. SNAP-SWITCH. Ingvald Larsen, Schenectady, N. Y., assignor to General Electric Co. Filed Oct. 2, 1907. Has a disk provided with a hole, a catch-plate containing a longitudinal slot having a circular enlargement at one end, and a connecting rod having a circular head to fit the enlarged slot and a wrist pin to engage with the hole in the disk, the rod lying in the same plane as the catch-plate and adapted to swing laterally in that plane.

994,022. PROCESS OF DISTILLATION. Robert J. McNitt, Niagara Falls, N. Y., assignor to Roessler & Hasslacher Chemical Co., New York, N. Y. Filed Sept. 18, 1909. The secondary of a transformer is an annular vessel containing the substance to be distilled. To be used especially in the case of substances which cannot be distilled by the application of external heat on account of the destructive effect of such heat upon the containing vessel.

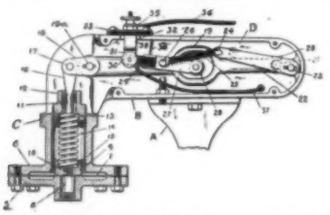
994,026. THERMAL ELECTRIC FIRE-ALARM. James William Mowbray, Gleichen, Alberta, Canada, assignor of one-half to William R. McKie. Filed July 18, 1910. Has a turnable shaft supported in the base, a conducting post supported in the base, and a flexible connection between the turnable shaft and the post, electric contacts and means on the shaft adapted to engage therewith.

994,030. TROLLEY-POLE ATTACHMENT. William A. Peffer, Louisville, Ky. Filed Oct. 24, 1910. A supplementary trolley wheel runs in advance of the current taking wheel, removing any foreign substances from the wire.

994,039. TROLLEY HEAD AND HARP. John Siragusa and Robert E. Wood, Chicago, Ill. Filed March 4, 1910. Has arms above the trolley wheel which prevent the trolley wheel from leaving the wire or aid in replacing it.

994,040. PUSH-BUTTON SWITCH. Max H. Spieiman, New York, N. Y., assignor to Joseph F. O'Brien, New York, N. Y. Filed Sept. 8, 1910. One of two contacts is in the form of an elbow lever mounted to change its position when engaged with the other contact. Means are provided for operating the contacts, whereby the other or second contact is engaged by the operating means to close the circuit and the first named contact or elbow lever is engaged by the operating means to open or break the circuit.

994,046. PROTECTIVE MEANS FOR SAFES. Wilson Weikel, deceased, by Earnest E. Weikel, administrator, Middletown, O. Filed Dec. 14, 1910. A tank containing an air-poisoning agent



993,977.—PRESSURE-OPERATED CIRCUIT CONTROLLER.

is provided with a fusible closure, and an electric circuit for fusing the closure. When forcible entry is attempted the closure is fused and the air-poisoning agent released.

994,050. FLUID CUT-OFF. William E. Apt and Edmund L. Schott, St. Joseph, and William H. Garland, Kansas City, Mo. Filed March 1, 1910. A lever is operated by an electromagnet tripping a trigger.

994,058. ARMATURE. Jesse Coates, Lynn, Mass., assignor to General Electric Co. Filed March 27, 1907. An armature of a substantially spherical shape comprising a plurality of coils crossing at the ends of the armature at an acute angle and a thin supporting shell for the coils formed of moldable material and having portions adapted to raise a coil above the coil immediately below it at the crossing point of the coils.

994,060. RAILWAY-SIGNAL. John P. Coleman, New York, N. Y., assignor to Union Switch & Signal Co., Swissvale, Pa. Original application filed May 2, 1910. Divided and this application filed Dec. 27, 1910. The switch arm is moved by a motor into its various positions.

994,067. BATTERY-WELL. Frank L. Dyer, Montclair, N. J., assignor to Thomas A. Edison, Inc., West Orange, N. J. Filed Nov. 8, 1910. Has walls formed of an infusible insoluble final phenolic condensation product and an inert filling body.

994,079. TELEGRAPH-TRANSMITTER. Benjamin P. Hayes, Topeka, Kan., assignor to American Transmitter & Manufacturing Co., Topeka, Kan. Filed May 17, 1910. A device has keys marked with characters by the depression of which corresponding impulses are transmitted.

994,080. MOTOR-CONTROLLER. Clark T. Henderson, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Filed Oct. 17, 1908. A controller for a plurality of motors has means for connecting the motors in series, and other means for conducting the motors in parallel and inherently reversing the operation thereof.

994,094. PORTABLE-LAMP APPARATUS. Richard Max Eaton, Niagara Falls, N. Y. Filed July 21, 1910. A miniature lamp is supplied with current from a battery which is carried on the user's back.

REISSUES.

13,247. ADJUSTABLE CASING FOR LAMP-SOCKETS. Edgar H. Freeman, Trenton, N. J. Filed Aug. 9, 1910. Original No. 927,334, dated July 6, 1909. The two members of the socket are held together by lugs and openings which lock together. Any lug fits any opening, permitting of circular adjustment of the cap.

13,248. SELF-ANSWERING SIGNAL SYSTEM. Edwin R. Gill, Yonkers, N. Y., assignor to Howard E. Merrell, New York, N. Y., and Orlo J. Hamlin, Smethport, Pa. Filed Dec. 13, 1910. Original No. 934,908, dated Sept. 21, 1909. Comprises a main line, an electromagnet having coils connected to the main line, an electromagnetic signal device, an electric circuit for the signal device including one or more coils on the first named electromagnet, and a circuit changer for the last named circuit, arranged to be operated by energizing the magnet.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired June 5, 1911:

520,763. MULTIPHASE-CURRENT MOTOR. Louis Bell, Boston, Mass.

520,764. METHOD OF AND MEANS FOR STARTING ALTERNATING-CURRENT MOTORS. Louis Bell, Boston, Mass.

520,773. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Hermann F. T. Erben, Schenectady, N. Y.

520,776. LIGHTNING-ARRESTER. John W. Gibboney, Lynn, Mass.

520,780. ELECTRIC-MOTOR TRUCK. John C. Henry, Westfield, N. J.

520,781. DYNAMO-ELECTRIC MACHINE. Albert B. Herrick, Schenectady, N. Y.

520,782. ELECTRIC MOTOR. Alfred Hinman, Olympia, Wash.

520,784. ELECTRIC-MOTOR CONTROLLER. William J. Hopkins and Theodore Stebbins, Boston, Mass.

520,786. EAR-PAD FOR TELEPHONE RECEIVERS. James W. Kinniburgh, Wellington, New Zealand.

520,787. ELECTIC LOCOMOTIVE. Walter H. Knight, Lynn, Mass.

520,788. STAND FOR CONTROLLING ELECTRIC CIRCUITS. Edward R. Knowles, Middletown, Conn.

520,789. VOLTMETER. Edward R. Knowles, Middletown, Conn.

520,794. ELECTRIC ELEVATOR. William D. Lutz, Philadelphia, Pa.

520,795. ELECTRO-PROTECTIVE SYSTEM FOR LOCKS. Morris Martin, Malden, Mass.

520,800. ALTERNATING-CURRENT MOTOR. Olof Offrell, Middletown, Conn.

520,809. MEANS FOR PREVENTING ARCING IN ELECTRIC POWER STATIONS. Elihu Thomson, Swampscott, Mass.

520,810. ELECTRIC RECIPROCATING MOTOR. Elihu Thomson, Swampscott, Mass.

520,811. ELECTRIC METER. Elihu Thomson, Swampscott, Mass.

520,822. SYSTEM OF CIRCUIT FOR ELECTRIC MACHINES. Charles E. Davies, Chicago, Ill.

520,852. ELECTRIC-SWITCH BOX. Edward R. Knowles, Middletown, Conn.

520,858. HYDROCARBON-MOTOR. Emory I. Nichols, San Francisco, Cal.

520,908. ELECTRIC-CIRCUIT REGULATOR. Harry F. Waite, New York, N. Y.

520,938. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Paul Plodeck, Sr., Cleveland, Ohio.

520,939. CONCENTRATOR. Almire H. Rapp, San Francisco, Cal.

520,940. DYNAMO-ELECTRIC MACHINERY. Coleman Sellers, Philadelphia, Pa.

520,964. VOLTMETER. Edward R. Knowles, Middletown, Conn.

520,965. SYSTEM OF ELECTRICAL DISTRIBUTION. Benjamin G. Lamme, Pittsburg, Pa.

520,970. METHOD OF ECONOMIZING THE ENERGY OF ALTERNATING CURRENTS. Charles F. Scott, Pittsburg, Pa.

520,972. PHOTOGRAPHIC-CAMERA SHUTTER. Abner G. Tisdell, Brooklyn, N. Y.

520,975. CONVERTER SYSTEM FOR ELECTRIC RAILWAYS. George Westinghouse, Jr., and Charles F. Scott, Pittsburg, Pa.

520,991. ELECTRIC-ARC LAMP. Louis E. Howard, Plainfield, N. J.

520,996. ELECTRIC-ARC LAMP. Louis B. Marks, New York, N. Y., and Clarence Ransom, Passaic, N. J.

521,010. CONDUIT ELECTRIC-RAILWAY SYSTEM. James B. Brand, Milwaukee, Wis.

521,046. ELECTRIC ANNUNCIATOR. Frederick W. Ross, Boston, Mass.

521,051. SYSTEM OF ELECTRICAL DISTRIBUTION BY ALTERNATING CURRENTS. Charles F. Scott, Pittsburg, Pa.

521,065. ELECTRIC ALARM CLOCK. John S. Whitehead, Detroit, Mich.

521,085. ELECTRICAL GOVERNOR FOR WATER-WHEELS. Carl S. English, Lowell, Mich.

521,089. ELECTRIC METER. Warren H. Reed, New Orleans, La.

521,124. SECTION INSULATOR. Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa.

521,125. ELECTRIC SUBWAY. James J. E. Philips, Brooklyn, N. Y.

521,131. INCANDESCENT LAMP. Detlaf C. Voss, Boston, Mass.

521,138. ELECTRIC MOTOR FOR DENTAL ENGINES. Walter A. Crowdus, Chicago, Ill.